

SAUGET AREA 2,
SAUGET, IL

RI/FS SUPPORT SAMPLING
PLAN VOL. 2B

WASTE, SOIL, STORMWATER,
GROUNDWATER & AIR
QUALITY ASSURANCE PROJECT
PLAN

Prepared for

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List Of Recipients

Gary Uphoff – Environmental Management Services
Steve Doss – BFI, Allied Waste Industries, Inc.
Joe Grana – Cerro Copper Products
Patrick A. Craig – CWM, Waste Management Industries
John Street – Ethyl Corp.
Dan Burnham – Exxon Mobil
Steven D. Smith – Solutia Inc.
Paul Pike – Union Electric

LIST OF ACRONYMS/ABBREVIATIONS

List of Acronyms/Abbreviations

%D	Percent difference
%R	Percent recovery
ABRTF	American Bottoms Regional Treatment Facility
AOC	Administrative order by consent
ARARs	Applicable or relevant and appropriate requirements
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLP	Contract laboratory program
COCs	Constituents of concern
CRDL	Contract required detection limits
DBMS	Database management system
DHU	Deep hydrogeologic unit
DQL	Data quality limits
DQO	Data quality objective
DSR	Duplicate sample result
EDD	Electronic disk deliverable
E&E	Ecology and Environment
EE/CA	Engineering evaluation/cost assessment
ERA	Ecological risk assessment
FCR	Field change request
FSP	Field sampling plan
GC/MS	Gas chromatograph/mass spectrometer
HHRA	Human health risk assessment
HRGC	High-resolution gas chromatography
HRMS	High-resolution mass spectrometry
ICP	Inductively coupled plasma
IEPA	Illinois Environmental Protection Agency
ISD	Industrial Salvage and Disposal, Inc.
LCS	Laboratory control sample
MDL	Method detection limit
MHU	Middle hydrogeologic unit
MS	Matrix spike
MSL	Mean Sea Level
MS/MSD	Matrix spike/matrix spike duplicate
MSD	Matrix spike duplicate
NIST	National Institute of Standards and Technology
OM	Operations manager
OSR	Original sample result
PCBs	Polychlorinated biphenyls
PCDD	Polychlorinated dibenzodioxin
PCDF	Polychlorinated dibenzofuran
PID	Photoionization detector
PM	Project manager
PQL	Practical quantitation limit
PRP	Potentially responsible party
QA	Quality assurance
QC	Quality control

LIST OF ACRONYMS/ABBREVIATIONS

QA/QC	Quality assurance/quality control
QAM	Quality assurance management
QAO	Quality assurance officer
QAPP	Quality assurance project plan
RAM	Real-time aerosol monitor
RI/FS	Remedial investigation/feasibility study
RPD	Relative percent difference
RPM	Remedial project manager
RSD	Relative standard deviation
SA2SG	Sauget Area 2 Sites Group
SHU	Shallow hydrogeologic unit
SOP	Standard operating procedure
SOW	Statement of work
SR	Sample result
SSP	Support Sampling Plan
SVOC	Semivolatile organic compound
TCLP	Toxicity characteristic leaching procedure
TOC	Total organic carbon
URS	URS Corporation
USCOE	United States Corp of Engineers
USEPA	United States Environmental Protection Agency
VOC	Volatile organic compound

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Project Description

1.0 ADMINISTRATIVE INFORMATION

Client Name: Sauget Area 2 Sites Group

Site Location: Sauget, Illinois

Program Manager: Robert B. Veenstra

Project Manager: Robert B. Billman

Site Safety Officer: Steven J. Shroff

Effective Dates: June, 2001 to December 31, 2002

APPROVAL:

Robert Veenstra
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Julie
of
IEPA*

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Project Description

1.1 INTRODUCTION

This Quality Assurance Project Plan (QAPP) has been prepared by URS Corporation (URS) on behalf of Sauget Area 2 Sites Group (SA2SG) as part of the Support Sampling Plan at the Sauget Area 2 Sites (the sites) in the Villages of Sauget and Cahokia, Illinois. This QAPP provides objectives, organization, functional activities, and specific Quality Assurance (QA) and Quality Control (QC) activities for sampling, sample handling and storage, chain of custody, and laboratory and field analysis efforts associated with sampling of environmental media at the sites and is one component of the Remedial Investigation/Feasibility Study (RI/FS) Support Sampling Plan (SSP).

This QAPP was developed using the following documents as guidance:

- USEPA Region V *Superfund Model Quality Assurance Project Plan (QAPP) Revision 1* (USEPA, 1996b)
- United States Environmental Protection Agency's (USEPA) *Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans*. QAMS-005-80 (USEPA, 1980)
- USEPA *Requirements for Quality Assurance Project Plans for Environmental Data Operation*, USEPA QA/R-5, (USEPA, 1994b).

The following quality assurance topics are addressed in this QAPP:

- Project description
- Project organization and responsibilities
- Quality assurance objectives for measurement
- Sampling procedures
- Custody procedures
- Calibration procedures and frequency
- Analytical procedures internal quality control checks
- Data reduction, validation, and reporting
- Performance and system audits

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- Preventative maintenance
- Specific routine procedures used to assess data precision, accuracy, and completeness
- Corrective action
- Quality assurance reports to management.

A complete site description for the Sauget Area 2 Sites is provided in Volume 1, Support Sampling Plan. This discussion addresses sites location, physical setting, a discussion of present and past facility operations and disposal practices for each site, a discussion of the regional and site-specific geology, hydrology, and hydrogeology, current and past groundwater uses, surrounding land use and populations, sensitive ecosystems, and meteorology/climatology.

1.2 CURRENT STATUS

The current status of this project is described in the Administrative Order by Consent (AOC) and its associated Scope of Work (SOW).

1.3 PROJECT OBJECTIVES

The purpose of the Support Sampling Plan (SSP) is to gather sufficient information from the Sauget Area 2 Sites to identify the nature of waste materials in Sites O, P, Q, R, and S and to assess the extent of migration of site-related constituents via the soil, groundwater, surface water, sediment, and air pathways and determination of constituent concentrations in aquatic and terrestrial biota.

Collected data will be used by others to prepare a Human Health Risk Assessment (HHRA), an Ecological Risk Assessment (ERA), and a Remedial Investigation/Feasibility Study (RI/FS). The SSP and Field Sampling Plan (FSP) (URS Corporation, 2001), include a description of the sample media, sample locations, number of samples, and analytical methods.

The main components of the SSP addressed in this Quality Assurance Project Plan (QAPP) include:

- Source area sampling (soil gas sampling, waste sampling, buried drum and tank identification)
- Groundwater sampling (upgradient, fill areas, downgradient alluvial aquifer, bedrock, slug tests, and grain size analysis)

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- Soil sampling (waste areas and background)
- Air sampling
- Treatability test sampling
- Stormwater sampling (exit routes from each site).

Table 1 lists sampling efforts, objectives, analyses, data uses, and analytical levels for this project. Specific analytical methods are listed in Table 2. Specific numbers of samples, frequency of QC samples, and types of analyses are listed in Table 3. Tables 4A and 4B list the laboratory standard operating procedure and quality assurance manual of Savannah Laboratories and Environmental Services, Inc. and Triangle Laboratories, Inc., respectively, which are used for monitoring activities. The remainder of this QAPP describes the specific approaches that will be taken to achieve the required Data Quality Objectives (DQOs).

1.3.1 Project Target Parameter and Intended Data Usages

The list of target parameters for this project is included in Tables 5A through 5Q.

1.3.2 Data Quality Objectives and Criteria for Measurement Data

The DQO Process is a series of planning steps based on the Scientific Method that is designed to ensure that the type, quantity, and quality of environmental data used in decision making are appropriate for the intended application. The DQO process is presented in *Guidance for the Data Quality Objectives Process*, USEPA QA/G-4 (USEPA, 1994a). DQOs are quantitative and qualitative statements derived from outputs of each step of the DQO process that:

- Clarify the study objective
- Define the most appropriate type of data to collect
- Determine the most appropriate conditions from which to collect the data.

The DQO process is developed through a multi-step process that includes the following:

- Step 1. State the problem to be resolved.
- Step 2. Identify the decision to be made.
- Step 3. Identify the inputs to the decision.

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- Step 4. Define the boundaries of the study.
- Step 5. Develop a decision rule.
- Step 6. Specify the tolerable limits on decision errors.
- Step 7. Optimize the design for obtaining the data.

The DQOs are then used to develop a scientific and resource sampling design. The DQO process allows decision makers to define their data requirements and acceptable levels of decision during planning before data are collected.

The DQOs developed for fill area waste, groundwater, soil, stormwater runoff, and air samples were used to develop a scientific and resource-effective sampling design and were based on the seven step process. The following sections describe the process used to develop the DQOs for each sample matrix type.

Step 1: State the problem - a description of the problem and specifications of available resources and relevant deadlines for-the study.

1. *Identify the members of the planning team* - The members of the planning team will include the SA2SG Remedial Project Manager, the ENSR Risk Assessor, the URS Project Officer, the URS Project Manager, the URS Quality Assurance Officer, the URS Field Leader, and the Savannah and Triangle Laboratories Project Managers.
2. *Identify the primary decision maker* - There will be no primary decision maker; decisions will be made by consensus.
3. *Develop a concise description of the problem* - The Sauget Area 2 Sites are identified as Sites O, P, Q, R, and S. Two of the five Sauget Area 2 Sites are located on the east bank of the Mississippi River (Sites Q and R). The other three sites (O, P and S) are located 1500 to 2000 feet east of the riverbank. Solid and liquid industrial and municipal wastes were disposed at these facilities from the 1950s to the 1980s. At two of the sites, wastes were placed in former borrow pit excavations (Sites Q and R). Wastes were placed in excavations at two other sites (Sites O and S), however, these excavations were made solely for the purpose of waste disposal. Wastes were placed at grade at the fifth site (Site P).

The potential exists for constituent migration through the soil and waste to the

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groundwater system. Stormwater runoff may also assist in the migration of constituents onto and off of the sites. As an example, past floods inundated Site Q, exposing drums and contaminated soils. Volatile organic compounds in groundwater may volatilize into outdoor air and may infiltrate into air in overlying buildings.

4. *Specify available resources and relevant deadlines for the study* – The SA2SG will provide the resources needed to meet the stated objectives. The project schedule is presented in Volume 1A, Section 15.0 of the SSP.

Step 2: Identify the decision - a statement of the decision that will use environmental data and the actions that could result from this decision.

1. *Identify the principal study decision* –

What is the nature and extent of waste material in the fill areas?

What is the nature and extent of constituent migration in groundwater and stormwater runoff?

What is the nature and extent of constituent migration due to overbank flooding and wind-blown dust deposition?

What is the tendency of site constituents to enter the atmosphere and what are the local wind patterns at the site?

2. *Define alternative actions that could result from resolution of the principle study question*

- a. Contaminant areas are characterized at the site, resulting in development of a site-specific risk assessment to develop -remediation goals.

- b. Contaminant areas are not identified, resulting in no further action.

3. *Combine the principle study question and the alternative actions into a decision statement* – Determine the nature and extent of waste material in the fill areas and conduct a site-specific risk assessment to develop remediation goals.

Determine the nature and extent of constituent migration in groundwater and stormwater runoff and conduct a site-specific risk assessment to develop remediation goals.

Determine the nature and extent of constituent migration due to overbank flooding and wind-blown dust deposition and conduct a site-specific risk assessment to develop remediation goals.

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Determine the tendency of site constituents to enter the atmosphere and the local wind patterns at the site and conduct a site-specific risk assessment to develop remediation goals.

4. *Organize multiple decisions.* Only one decision is being evaluated.

Step 3: Identify inputs to the decision - a list of environmental variables or characteristics that will be measured and other information needed to resolve the decision statement.

1. *Identify the information that will be required to resolve the decision statement-* To resolve the decision statement, the planning team needs to obtain measurements of contaminants, including VOCs, SVOCs, pesticides, herbicides, metals, PCBs, and dioxin, as presented in Table 1, at the site.
2. *Determine the sources for each item of the information identified* - The samples will be tested using the methods listed in Table 2.
3. *Identify the information that is needed to establish the action level* - Samples will be collected at Sites O, P, Q, R, and S in accordance to the FSP and will be analyzed for VOCs, SVOCs, PCBs, pesticides, herbicides, metals, and dioxin. Based on the information generated through this study, the evaluation of potential human health risks and consideration of preliminary remediation goals will be developed. Because the air samples are 24-hour samples and collected at a single time point, they will not be used in the calculation of risks in the Human Health Risk Assessment. However, the data will be compared to chronic and, if appropriate, to subchronic or acute criteria. Initial comparison will be made to USEPA Region 9 Preliminary Remediation Goals.

Constituents of Concern (COCs) will be identified in the risk assessment and remedial goals will be developed for the COCs based on exposure pathways evaluated in the risk assessment.

4. *Confirm the appropriate measurement methods exist to provide the necessary data* - VOCs, SVOCs, PCBs, pesticides, herbicides, metals and dioxin can be measured using the USEPA methods listed in Table 2. The laboratory detection limits for the analyses are listed in Tables 5A through 5P.

Step 4: Define the boundaries of the study - a detailed description of the spatial and temporal boundaries of the problem, characteristics that define the population of interest, and any practical considerations of interest.

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1. *Specify the characteristics that define the population of interest* – Waste, groundwater, soil, stormwater runoff, and air samples will be collected in the vicinity of Sites O, P, Q, R, and S.
2. *Define the spatial boundary of the decision statement* -
 - a. *Define the geographic area to which the decision statement applies* -Decisions will apply to areas in the vicinity of Sites O, P, Q, R, and S.
 - b. *When appropriate divide the population into strata that have relatively homogenous characteristics* – Waste are divided into the following categories: Sites O, P, Q, R, and S. Air samples are separated into the following categories: Sites P, ORS, and Q. Sites O, R, and S (ORS) will be sampled together. Groundwater samples are divided into alluvial aquifer, bedrock aquifer, and background. Soil samples are divided into the following categories: surface (0 to 0.5 ft), subsurface (0.5 ft to 6 ft below ground surface) and background. Stormwater runoff samples will be classified by the Site and by the storm event.
3. *Define the temporal boundary of the decision statement* -
 - a. *Determine the time frame to which the decision statement applies* -It will be assumed that the sampling data will represent current concentrations in the media.
 - b. *Determine when to collect the data* – Waste, groundwater, soil, stormwater runoff, and air samples will be collected during one sampling round (to the extent possible) and analyzed for VOCs, SVOCs, PCBs, pesticides, herbicides, metals, and dioxin constituents associated with the analytical methods listed in the FSP. One sampling round for stormwater runoff will include the collection of samples after three storm events.
4. *Define the scale of decision making*- The scale of decision making will be from the sampling site for the one sampling round.
5. *Identify practical constraints on data collection* - The most important practical constraint that could interfere with the study is interference in the ability to collect samples in the field due to inclement weather.

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Step 5: Develop a decision rule - to define the parameter of interest, specific the action level and integrate previous DQO outputs into a single statement that describes a logical basis for choosing among alternative actions.

1. *Specify the statistical parameter that characterizes the population of interest* - The laboratory results from the one sampling event will characterize the population of interest. A statistical parameter is not being used because only one sampling event is scheduled; the small sample size would not result in meaningful sample statistics.
2. *Specify the action level for the study*- For waste, groundwater, soil, and stormwater samples, preliminary remediation goals will be developed based on readily available information, such as chemical specific ARARs, or other reliable information. Preliminary remediation goals will be modified, as necessary, as more information becomes available during the RI/FS. Final remediation goals will be determined when the remedy is selected. Remediation goals will establish acceptable exposure levels that are protective of human health and the environment and will be developed as described above in part 3 of Step 3. Because the air samples are 24-hour samples collected at a single time point, they will not be used, in the calculation of risks in the Human Health Risk Assessment. However, the data will be compared to chronic and, if appropriate, to subchronic or acute criteria. Initial comparison will be made to USEPA Region 9 Preliminary Remediation Goals for Air (USEPA, 1986c). Remediation goals will establish acceptable exposure levels that are protective of human health and the environment and will be developed as described in the Human Health Risk Assessment Work Plan in Section 11 of the SSP.
3. *Develop a decision rule* -
 - a. If VOCs, SVOCs, PCBs, pesticides, herbicides, metals, and dioxin measurements exceed preliminary remediation goals, use site specific risk assessment to develop remediation goals and complete the RI/FS report.
 - b. If VOCs, SVOCs, PCBs, pesticides, herbicides, metals, and dioxin measurements do not exceed preliminary remediation goals, no additional action is needed.

Step 6: Specify tolerable limits on decision errors - the decision maker's tolerable decision error rates based on a consideration of the consequences of making a decision error.

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1. *Determine the possible range of the parameter of interest* - The range of the expected constituents varies. The laboratory analysis will screen samples and adjust for the concentration ranges during the analysis process.
2. *Identify the decision errors and choose the null hypothesis* -

- a. *Define both types of decision errors and establish the true state of nature for each decision error* - The planning team has determined that the two decision errors are (I) deciding that the nature and extent of contamination is not already defined when it truly is; and (II) deciding that the nature and extent of contamination is defined when it truly is not.

The true state of nature for the decision error (I) is that the nature and extent of ambient air contamination is defined.

The true state of nature for the decision error (II) is that the nature and extent of ambient air contamination is not defined.

- b. *Specify and evaluate the potential consequences of each decision error*- The consequences of deciding that the extent of contamination is not defined when it truly is will be that incorrect information is used in the risk assessment to develop remediation goals.

The consequences of deciding that the extent of contamination is defined when it truly is not will be that the presence of constituents of concern in the relevant media may pose a threat to human health or the environment.

- c. *Establish which decision error has more severe consequences of each decision error*- The planning team has concluded that the decision error (II) has more severe consequences near the action level because the risk of jeopardizing human health outweighs the consequences of having incorrect information for risk assessment and remediation goal development.
- d. *Define the null hypothesis (baseline condition) and the alternative hypothesis and assign the terms "false positive" and "false negative" to the appropriate decision error* - The baseline condition or null hypothesis is "the nature and extent of contamination is not defined."

The alternative hypothesis is "the nature and extent of contamination is defined."

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Project Description

The false positive decision error occurs when the null hypothesis is rejected when it is true.

The false negative decision error occurs when the null hypothesis is not rejected when it is true.

3. *Specify the range of possible values of the parameters of interest where the consequences of decision errors are relatively minor (grey area)* - In this case, because the sample size is small, statistical methods cannot be used for data collection designs. Therefore, in order to avoid false negative decision errors, qualitative guidelines will be established.
4. *Assign probability values to points above and below the action- level that reflect the tolerable probability for the occurrence of decision errors* - Not applicable to the data collection design.

Step 7: Optimize the plan

1. *Review the DQO outputs and existing environmental data* - In 1998, Ecology and Environment (E&E) prepared the report "Sauget Area 2 Data Tables/Maps" for USEPA Region 5. This report summarized existing data for each site along with other information compiled by E&E during its file searches of various agencies and organizations. It contains data from investigations conducted by Clayton Environmental Consultants, Dynamac, E&E, IEPA, Geraghty and Miller, Reidel Industrial Waste Management, Russell and Axon and USEPA. Data for Sites O, P, Q, R and S are summarized in Sections 3.1 through 3.5 of the SSP.
2. *Develop the general data collection design* - The data collection design will involve one ambient air sampling round. QC samples will be collected as described on Table 3 of this QAPP. Following review of the results of the sampling round, a decision will be made to either reject the null hypothesis, or accept the null hypothesis.

Specific data quality requirements, such as criteria for precision, accuracy, representativeness, completeness, comparability, and sensitivity, are specified in Chapter 3 of this QAPP.

Laboratory analyses and analytical levels will adhere to the guidelines described in USEPA's *Data Quality Objectives Process For Superfund, Interim Final Guidance* (USEPA, 1993c). Analytical levels are defined in the guidance document as follows:

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Project Description

- Screening data are defined as data generated by rapid, less precise methods of analysis with less rigorous sample preparation. For this project, screening data will be generated for pH, turbidity, temperature, and conductivity through field measurements. The level of QC that will be performed for the field measurements includes the QC efforts for pH, field conductivity, turbidity, and temperature measurements described in section 3.7. The field instrument calibration procedures are described in Appendix C. The quality objectives for precision and accuracy are listed in Tables 6A through 6N of this QAPP.

Definitive data are data generated using rigorous analytical methods, such as USEPA reference methods. Data are analyte-specific, with confirmation of analyte identity and concentration. For this project, definitive data will be generated by the analysis of soil, groundwater, stormwater runoff, and air for organics and inorganics by USEPA methods. The level of QC that will be performed for the definitive data includes the QC efforts described in section 3.7, the calibration procedures described in Appendix A, the laboratory quality control checks described in section 8.2, the QC requirements listed in Tables 7A through 7I, and the control limits listed in Tables 6A through 6N of this QAPP.

1.4 SAMPLE DESIGN AND RATIONALE

The sample network design is described in the FSP.

1.4.1 Sample Network by Task and Matrix

The field sampling summary information, including the parameters, matrices, number of environmental samples, and the frequency of associated QC samples, is presented in Table 3. Each sample collection activity is described in the FSP.

1.4.2 Site Maps of Sampling Locations

Site plans showing sampling locations are located in Figures 1 through 12 of the FSP.

1.4.3 Rationale of Selected Sampling Locations

The sample network design is described in the SSP and the FSP.

1.5 PROJECT SCHEDULE

The estimated project schedule is presented in the Volume 1A, section 15.0 of the SSP.

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Project Organization and Responsibility

URS will perform the field activities, prepare the report, and provide project management for support sampling activities. Analytical services for this QAPP will be provided by either Severn-Trent Laboratories - Savannah (Savannah Labs) in Savannah, Georgia and/or Lancaster Laboratories (Lancaster Lab) in Lancaster, Pennsylvania. Analytical services for dioxin and dibenzofuran for this SSP will be provided by triangle laboratories, inc. (Triangle Labs) in Durham, North Carolina. AMEC Environmental, Inc. will perform the Ecological Risk Assessment, and ENSR will perform the Human Health Risk Assessment. The various quality assurance and management responsibilities of key project personnel are defined below.

2.1 PROJECT ORGANIZATION

Sections 2.2 through 2.5 of this QAPP present the responsibilities of the key project personnel, and the lines of authority for the project personnel are described in each section. Figure 1 is a project organization chart for the project.

2.2 MANAGEMENT RESPONSIBILITIES

2.2.1 USEPA Region V Remedial Project Manager

Michael Ribordy will serve as the USEPA Region V Remedial Project Manager (USEPA RPM). As such, he will have overall responsibility for all phases of the SSP.

2.2.2 Illinois Environmental Protection Agency (IEPA) Remedial Project Manager

Candy Morin will serve as the IEPA Remedial Project Manager.

2.2.3 SA2SG Remedial Project Manager

Steven D. Smith of Solutia Inc. will serve as the SA2SG Project Coordinator. As such, he will have the overall responsibility for all phases of the SSP. He will be responsible for implementing the project, and will have the authority to commit the resources necessary to meet project objectives and requirements. His primary function is to verify that technical, financial, and scheduling objectives are achieved successfully. He will provide the major point of contact and control for matters concerning the project. The SA2SG Project Coordinator will:

- Define project objectives and develop a sampling plan schedule
- Establish project policy and procedures to address the specific needs of the project as a whole, as well as the objectives of each task

SECTION TWO

Project Organization and Responsibility

- Acquire and apply technical and financial resources as needed to verify performance within budget and schedule constraints
- Monitor and direct the field leaders
- Develop and meet ongoing project staffing requirements
- Review the work performed on each task to verify its, quality, responsiveness, and timeliness
- Review and analyze overall task performance with respect to planned requirements and authorizations
- Approve reports before their submission to USEPA Region V
- Ultimately be responsible for the preparation and quality of reports
- Represent the SA2SG at meetings.

2.2.4 URS Project Officer

Robert B. Veenstra will serve as the URS Project Officer. As such, he is responsible for the overall administration and technical execution of the project. He will report directly to the SA2SG Project Coordinator.

2.2.5 URS Project Manager

Robert B. Billman will serve as the URS Project Manager (PM). As such, he will have overall responsibility for verifying that the project meets the stated objectives and URS's quality standards. He will report directly to the URS Project Officer and is responsible for technical quality control and project oversight.

2.3 Quality Assurance (QA) Responsibilities

2.3.1 URS Data Validator

John Kearns of URS will serve as the lead third party data validator. As such, he will remain independent of direct job involvement and day-to-day operations and have direct access to corporate executive staff as necessary to resolve QA disputes. The data validator will be responsible for auditing the implementation of the QA program in conformance with the

SECTION TWO

Project Organization and Responsibility

demands of specific investigations, URS's policies, and USEPA requirements. The specific functions that he or a designee perform may include:

- Providing QA audits on various phases of the field operations
- Reviewing and approving the QA plans and procedures
- Reporting on the adequacy, status, and effectiveness of the QA program on a regular basis to the SA2SG Project Coordinator
- Data validation of sample results from the analytical laboratory, as appropriate.

2.3.2 URS QA Officer

Steven Shroff will serve as the URS QA Officer (QAO). As such, he will report directly to the URS Project Officer and will be responsible for verifying that all URS QA procedures for this project are being followed. In addition, he will be responsible for seeing that internal laboratory audits are conducted as specified in Section 10.

2.3.3 USEPA Region V Quality Assurance Reviewer

Michael McAteer, the USEPA Region V RPM, or a designee, will serve as the USEPA Region V Quality Assurance Reviewer. As such, he will have the responsibility to review and approve the QAPP. In addition, he will be responsible for conducting external performance and system audits of the laboratory and field activities, and reviewing and evaluating analytical laboratory and field procedures.

2.4 FIELD RESPONSIBILITIES

2.4.1 URS field leader

Steven Shroff, or a designee, will serve as the URS Field Leader. He will be responsible for leading, coordinating, and supervising the day-to-day field activities. His responsibilities include:

- Provision of day-to-day coordination with the URS PM on technical issues
- Develop and implement field-related sampling plans and schedule
- Coordinate and manage field staff
- Supervise or act as the field sample custodian
- Implement the QC for technical data, including field measurements

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Project Organization and Responsibility

- Adhere to work schedules
- Authorize and approve text and graphics required for field team efforts
- Coordinate and oversee technical efforts of subcontractors assisting the field team
- Identify problems at the field team level, resolve difficulties in consultation with the URS PM, implement and document corrective action procedures, and provide communication between team and upper management
- Prepare the final report.

2.4.2 URS Field Team

The technical staff will be drawn from URS's pool of resources. The technical staff will be utilized to gather and analyze data, and to prepare various task reports and support materials. The technical staff are experienced professionals who possess the degree of specialization and technical competence required to effectively and efficiently perform the required work.

2.5 LABORATORY RESPONSIBILITIES

Specific information concerning the analytical laboratory Quality Assurance Plans, including a more thorough discussion of responsibilities can be found in Volume 5.

2.5.1 Laboratory Project Manager

Laboratory project managers will report directly to the SA2SG Project Coordinator and will be responsible for the following:

- Ensuring the resources of the laboratory are available on an as-required basis
- Reviewing the final analytical report
- Approving final analytical reports prior to submission to the data validation contractor.

2.5.2 Laboratory Operations Manager (OM)

Laboratory operations managers will report to their respective Laboratory PM and will be responsible for:

- Coordinating laboratory analysis
- Supervising in-house chain-of-custody

SECTION TWO

Project Organization and Responsibility

- Scheduling sample analysis
- Overseeing data review
- Overseeing preparation of analytical reports
- Approving final analytical reports.

2.5.3 Laboratory Quality Assurance Officer

Laboratory quality assurance officers will have overall responsibility for data after it leaves the analyst and before it leaves the laboratory. The Laboratory QAO will be responsible for the following:

- Overseeing laboratory quality assurance
- Overseeing Quality Assurance/Quality Control (QA/QC) documentation
- Conducting detailed data review
- Deciding whether to implement laboratory corrective actions, if required
- Defining appropriate laboratory QA procedures
- Preparing laboratory standard operation procedures (SOPs)
- Approving the laboratory QAPP.

2.5.4 Laboratory Sample Custodian

Laboratory sample custodians will report to their respective Laboratory OM. Their responsibilities will include the following:

- Receiving and inspecting the incoming sample containers
- Recording the condition of the incoming sample containers
- Signing appropriate documents
- Verifying the chain-of-custody and its correctness
- Notifying the Laboratory PM of sample receipt and inspection
- Assigning a unique identification number and entering each into the sample receiving log
- Controlling and monitoring access and storage of samples.

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Project Organization and Responsibility

Final responsibility for the project quality rests with the URS PM. Independent quality assurance will be provided by each Laboratory PM and Laboratory QAO prior to release of all data to URS.

2.5.5 Laboratory Technical Staff

The laboratory technical staff will be responsible for sample analysis and identification of corrective actions. The staff will report directly to their respective Laboratory OM.

SECTION THREE

Quality Assurance Objectives for Measurement

The overall QA objective for this QAPP is to develop and implement procedures for field sampling, chain-of-custody, laboratory analysis, and reporting that will provide results which are legally defensible in a court of law. Specific procedures for sampling, chain-of-custody, laboratory instrument calibration, laboratory analysis, reporting of data, internal quality control, audits, preventive maintenance of field equipment, and corrective action are described in other sections of this QAPP.

The control limits for precision and accuracy to be used for each laboratory analysis in this SSP are listed in Tables 6A through 6N. The analytes and detection limits for each analysis are listed in Tables 5A through 5Q.

3.1 PRECISION

3.1.1 Definition

Precision is a measure of the degree to which two or more measurements are in agreement.

3.1.2 Field Precision Objectives

Field precision is assessed through the collection and measurement of field duplicates at a rate of one duplicate per ten analytical samples. The total number of duplicates for this QAPP is found in Table 3. Precision control limits are presented in Tables 6A through 6N.

3.1.3 Laboratory Precision Objectives

Precision in the laboratory is assessed through the calculation of relative percent differences (RPD) and relative standard deviations (RSD) for two or more replicate samples. The equations to be used for precision in this QAPP are presented in Chapter 12 of this QAPP. Precision control limits are presented in Tables 6A through 6N.

3.2 ACCURACY

3.2.1 Definition

Accuracy is the degree of agreement between an observed value and an accepted reference value.

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Quality Assurance Objectives for Measurement

3.2.2 Field Accuracy Objectives

Accuracy in the field is assessed through the use of field and trip blanks and through the adherence to all sample handling, preservation, and holding times. Accuracy control limits are presented in Tables 6A through 6N.

3.2.3 Laboratory Accuracy Objectives

Laboratory accuracy is assessed through the analysis of matrix spikes (MS), standard references, or laboratory control samples (LCSs), and the determination of percent recoveries. The equation to be used for accuracy in this QAPP is presented in Chapter 12. Accuracy control limits are presented in Tables 6A through 6N.

3.3 COMPLETENESS

3.3.1 Definition

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions.

3.3.2 Field Completeness Objectives

Field completeness is a measure of the amount of valid measurements obtained from all the measurements taken in the project. Field completeness for this project will be greater than 90 percent. In the event that the field completeness target of greater than 90 percent is not achieved, additional samples may be collected and analyzed so that the 90 percent goal will be achieved or a report will be issued explaining why the goal was not met and if the task can be considered complete.

3.3.3 Laboratory Completeness Objectives

Laboratory completeness is a measure of the amount of valid measurements obtained from all the laboratory measurements taken in the project. The equation for completeness is presented in Chapter 12 of this QAPP. Laboratory completeness for this project will be greater than 95 percent. In the event that the laboratory completeness target of greater than 95 percent is not achieved, additional samples may be collected and analyzed so that the 95 percent goal will be achieved or a report will be issued explaining why the goal was not met and if the task can be considered complete.

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Quality Assurance Objectives for Measurement

3.4 REPRESENTATIVENESS

3.4.1 Definition

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition.

3.4.2 Measurement to Ensure Representativeness of Field Data

Representativeness is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the SSP and FSP are followed and that proper sampling techniques are used.

3.4.3 Measures to Ensure Representativeness of Laboratory Data

Representativeness in the laboratory data is ensured by using the proper analytical procedures, meeting sample holding times, and analyzing and assessing the field duplicate samples. The sampling network is designed to provide data representative of site conditions. During development of this network, consideration is given to existing analytical data, past site practices, and physical setting and processes. The rationale of the sampling network is discussed in the SSP and the FSP.

3.5 COMPARABILITY

3.5.1 Definition

Comparability is an expression of the confidence with which one data set can be compared with another. Comparability is also dependent on similar QA objectives.

3.5.2 Measures To Ensure Comparability of Field Data

Comparability is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the SSP and FSP are followed and that proper sampling techniques are used.

3.5.3 Measures to Ensure Comparability of Laboratory Data

Planned analytical data will be comparable when similar sampling and analytical methods are used and documented in the QAPP. Comparability is also dependent on similar QA objectives.

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Quality Assurance Objectives for Measurement

3.6 SENSITIVITY

3.6.1 Definition

Sensitivity refers to a measurable concentration of an analyte which has an acceptable level of confidence.

3.6.2 Measures to Ensure Comparability of Laboratory Data

Sensitivity is measured through the determination of detection limits for each analytical method. Method detection limits (MDLs) are the lowest concentration of an analyte that can be measured with 99% confidence that the analyte concentration is greater than zero. Practical quantitation limits (PQLs) are levels above the MDLs at which the laboratory has demonstrated the quantitation of analytes. The sensitivity of the analytical methods is dependent upon whether the methods associated with this project have PQLs and MDLs at sufficiently low levels to adequately assess the project DQOs. Field sampling personnel, the analytical laboratory, the data validator and risk assessors (human health and ecological) will work together and to ensure that PQLs are as low as feasible for the media being sampled and that sample analytical results will achieve data quality levels (DQLs) within the limits of the selected analytical method. The PQLs and MDLs are presented in Tables 5A through 5P. The PQLs for waste samples that are to be prepared using the USEPA TCLP procedures and that are analyzed for VOCs, SVOCs, pesticides, PCBs, herbicides, metals, dioxins and dibenzofurans, are the same as the PQLs presented for VOCs, SVOC, pesticides, PCBs, herbicides, metals, dioxins and dibenzofurans. The PQLs and MDLs presented in the VOC table for soil are based on USEPA Method 5035 preparation procedure.

3.7 LEVEL OF QUALITY CONTROL EFFORT

Field blanks, trip blanks, method blanks, duplicates, reference standards, and spike samples will be analyzed to assess the quality of the data resulting from the field sampling and analytical programs.

The following are the field and laboratory QA/QC measures used to evaluate data quality.

A field blank (or equipment blank) will be collected and submitted to the laboratory with the investigative samples and analyzed for the same parameters as the investigative samples with the exception of soil gas and air samples. Field blanks consist of distilled or de-ionized water which

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Quality Assurance Objectives for Measurement

is poured over cleaned sampling equipment in between sample collections. Field blanks are analyzed to check for procedural contamination at the site which may cause sample contamination. The minimum required is one per every ten samples or one per sampling day if less than ten samples are collected, unless dedicated sampling equipment is used to collect samples.

A trip blank must be included in each cooler which contains samples for VOC analysis and is analyzed by the laboratory for VOCs for all sites at which VOCs (soil, air, or water) are one of the analytical parameters. The trip blank consists of organic-free water placed in one or more VOC vials, and is transported to the sampling site unopened, stored with the investigative samples, and kept closed until analyzed by the laboratory. Trip blanks are used to assess the potential for VOC contamination of samples due to constituent migration during sample shipment. One trip blank is required for each shipping container which contains samples collected for VOC analysis.

Method blanks are used to assess contamination resulting from the laboratory procedures. The laboratory must run a method (preparation) blank at the beginning of each analytical run for each day that the analysis is performed. If not all sample analyses are completed in one day, a minimum of one method blank per sample matrix per analytical method must be run at the beginning of each sample batch analyzed each day.

Field duplicates must be collected for each matrix sampled. Field duplicate samples are analyzed as a check of sampling and analytical reproducibility; laboratory duplicates provide an estimate of the reproducibility of measurement. The field duplicate will be analyzed for all parameters for which the investigative samples of that matrix are analyzed. The minimum number of field duplicates required is one per every ten samples or, if there are fewer than ten samples, one per matrix.

Matrix spikes (MSs) provide information about the effect of the sample matrix or digestion and measurement methodology. MSs for organic analyses will be performed in duplicate (MSD). The spike duplicate will be performed for inorganic analyses. MS or spike duplicate samples will be collected at a frequency of one for every twenty samples collected, or, if fewer than twenty samples per matrix, one for each matrix sampled. The MS/MSD and spike duplicate is an investigative sample which (for each applicable analytical parameter for that sample matrix) is

SECTION THREE **Quality Assurance Objectives for Measurement**

spiked with target analytes for that analytical procedure, and analyzed with the other samples of that matrix. Samples chosen as MS/MSD and spike duplicates should be selected prior to the sampling event so that sufficient sample volume is acquired.

Laboratory control samples (LCSs) are standard solutions that consist of known concentrations of the target analytes spiked into laboratory organic-free distilled water or clean sand. They are prepared or purchased from a source independent from the calibration standards to provide an independent verification of the calibration procedure. They are spiked with all target analytes for each analysis. These QC samples are then prepared and analyzed following the same procedures employed for environmental sample analysis to assess method accuracy independently of sample matrix effects. The laboratory will prepare and analyze an LCS with each group of twenty samples of similar matrix that are extracted, digested, or analyzed at the same time (within same 12-hr period) for gas chromatograph/mass spectrometer (GC/MS) analysis. Percent recoveries will be evaluated using laboratory established control limits to assess the efficiency of preparation and analysis method independent of environmental sample matrix effects.

Upon initiation of an analytical run, the laboratory must perform calibration procedures as instructed by the analytical methods used. During the length of the run, calibration verifications must be performed at the frequency specified to verify the initial calibration.

Surrogates must be added to all samples for organic analysis. Surrogate recovery will be used to assess accuracy of organic analyses.

Control limits are the maximum and/or minimum values which define a range for a specific parameter, as outlined within each analytical procedure, at which sample results are considered to satisfactorily meet quality control criteria. When the parameter falls outside that range, the procedure is considered to be out-of-control. Whenever the analytical procedure is or becomes out-of-control, corrective action must be taken to bring the analysis back into control. The corrective action must include:

1. Finding the cause of the problem
2. Correcting the problem
3. Demonstrating the problem has been corrected by reanalyzing appropriate laboratory reference samples

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Quality Assurance Objectives for Measurement

4. Repeating the analysis of any investigative samples that may have been affected by the control problem.

Exceptions will be made on a case-specific basis. Documentation must include evidence that a good-faith effort was made to meet the control limit; this may include two attempts to analyze the sample. The level of QC effort provided by the laboratory will be equivalent to the level of QC effort specified in the methods listed in Table 3.

The following are the field equipment QC efforts for the project.

Field analytical equipment will be calibrated prior to each day's use, in the middle of the day (approximately every four hours), and more frequently if required. The calibration procedures will conform to manufacturer's standard instructions. This calibration will ensure that the equipment is functioning within the allowable tolerances established by the manufacturer and required by the project. Records of all instrument calibration will be maintained by the URS PM and will be subject to audit by the URS QAO. Copies of all of the instrument manuals will be maintained on-site by the URS Field Leader.

The level of QC effort for the field measurement of pH involves calibration of the pH meter which will be performed immediately prior to each day's use, in the middle of the day (approximately every four hours), and more frequently if required. National Institute of Standards and Technology (NIST)-traceable standard buffer solutions which bracket the expected pH range will be used. The standards will most likely be pH of 7.0 and 10.0 standard units. The use of the pH calibration and slope knobs will be used to set the meter to display the value of the standard being checked. The calibration data will be recorded on calibration sheets maintained on-site.

The QC effort for field turbidity measurements will include calibration checks using the turbidity standard which will be performed immediately prior to each day's use, in the middle of the day (approximately every four hours), and more frequently if required. The portable turbidity meter will be calibrated using a reference solution specified by the manufacturer. Readings must be within 10 percent to be acceptable.

The QC effort for field conductivity measurements will include calibration checks using the conductivity standard which will be performed immediately prior to each day's use, in the

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Quality Assurance Objectives for Measurement

middle of the day (approximately every four hours), and more frequently if required. The portable conductivity meter will be calibrated using a reference solution specified by the manufacturer. Readings must be within 5 percent to be acceptable.

The QC effort for photoionization detector (PID) measurements will include calibration checks using calibration gas which will be performed immediately prior to each day's use, in the middle of the day (approximately every four hours), and more frequently if required.

The QC effort for field gas chromatograph measurements will include development of a three- or five-point calibration curve, analysis of a method blank at the start of each day and at the rate of one per every ten samples collected, and through the performance of continuing calibration checks at the start of each day and at a rate of one per every ten samples collected to verify that operation of the measurement system is in control and not varying.

The QC effort for explosimeter measurements will be maintained by using a simultaneous zero calibration and span calibration procedure as outlined in Appendix C of this document.

The QC effort for real-time aerosol monitor (RAM) measurements will be maintained by using an internal calibration method installed by the factory when the instrument is manufactured. The factory calibrates the instrument to the standard ISO 12103-1, A1 test dust. The calibration data is stored internally and cannot be accessed. This standard test dust is used because of its wide particle size distribution which makes the internal calibration representative of an average of most types of ambient aerosol that may be encountered.

The QC effort for magnetometer measurements will include calibration of the magnetometer to an approximate value based on established magnetic intensity for the region available in reference documents. Additionally, quality control will be maintained by visually inspecting the data as they are acquired. If the equipment signals a data collection problem during measurement of data, the measurement point is recollected.

SECTION FOUR

Sample Procedures

The following sampling procedures and practices that will be used in the SSP are presented in the FSP and in the Health and Safety Plan (URS Corporation, 2001):

- Waste sampling
- Groundwater sampling
- Soil sampling
- Air sampling
- Stormwater sampling
- Treatability test sampling
- Monitoring well installation
- Sample custody procedures
- Decontamination procedures.

The sample identification system will involve the following:

- Soil gas survey data will be labeled SG-P-1 where "SG" denotes soil gas survey, "P" is the site designation, and "1" denotes a sequential sample number.
- Waste samples will be labeled WASTE-P-__FT where "WASTE" denotes a waste sample, "P" is the site designation, and "__FT" indicates sample depth, which is filled in by the sampler.
- Leachate samples will be labeled LEACH-P-1 where "LEACH" denotes a leachate sample, "P" is the site designation, and "1" denotes a subsequent sample number.
- Alluvial aquifer samples will be labeled AA-P-S1-__FT where "AA" denotes an alluvial aquifer sample, "P" is the site designation, "S1" is the sequentially numbered sampling station, and "__FT" indicates sample depth, which is filled in by the sampler.
- Bedrock groundwater samples will be labeled BR-1 and BR-2 where "BR" denotes a bedrock groundwater sample and "1" and "2" denote sequential numbers that correspond to the monitoring well ID.

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- Background groundwater samples will be labeled BAA-S1-__FT where “BAA” denotes a background alluvial aquifer sample, “S1” is the sequentially number sampling station, and “__FT” indicates sample depth.
- Piezometer soil samples will be labeled PIEZ-S1-__FT where “PIEZ” denotes a piezometer soil sample, S1 is the sequentially number sampling station, and “__FT” indicates sample depth.
- Soil samples will be labeled SOIL-P-S1-__FT where “SOIL” denotes a soil sample, “P” is the site designation, “S1” is the sequentially numbered sampling station, and “__FT” indicates sample depth.
- Background soil samples will be labeled BS-S1-__FT where “BS” denotes a background soil sample, “S1” is the sequentially numbered sampling station, and “__FT” indicated sample depth, which is filled in by the sampler.
- Air samples will be labeled AIR-P-V-1, AIR-P-S-1, or AIR-P-M-1 where “AIR” denotes an air sample, “P” is the site designation, “V”, “S”, “P”, “H”, “C”, “D”, or “M” designate a VOC, SVOC, pesticide, herbicide, PCB, dioxin, or metals sample, respectively, and “1” denotes a sequential sample number.
- “MS/MSD” or “DUP” at the end of a sample identification will indicate a matrix spike/matrix spike duplicate/spike duplicate or a duplicate sample, respectively.
- Stormwater samples will be labeled STORM-P-1 where “STORM” denotes stormwater, “P” is the site designation, and “1” denotes a sequential sample number.
- Off-site incineration pilot test samples will be labeled WI-P-1 where “WI” denotes a waste sample for off-site incineration testing, “P” is the site designation, and “1” denotes a sequential sample number.
- Off-site disposal pilot test samples will be labeled DISPOSE-P-1 where “DISPOSE” denotes a waste number sample for off-site disposal testing, “P” is the site designation, and “1” denotes a sequential sample number
- On-site thermal desorption pilot test samples will be labeled TD-P-1 where “TD” denotes a waste sample for on-site thermal desorption testing, “P” is the site designation, and “1” denotes a sequential sample number.

SECTION FOUR

Sample Procedures

- On-site physical/chemical leachate treatment pilot test samples will be labeled PCHEM-P-1 where "PCHEM" denotes a leachate sample for on-site physical/chemical testing, "P" is the site designation, and "1" denotes a sequential sample number.
- Off-site biological leachate pilot test samples will be labeled BIO-P-1 where "BIO" denotes a leachate sample for off-site biological testing, "P" is the site designation, and "1" denotes a sequential sample number.

Table 3 lists the sample volumes suggested for wastes, soil, groundwater, and air samples collected for this project, as well as the holding times, the proper containers, and the required preservation.

Instructions for collecting QC sample for each matrix, including field duplicates, field blanks, MS/MSDs, and spike duplicates are described in the FSP.

Care should be taken that sufficient sample volume is provided for all necessary analyses to be performed. This applies to field blanks, field duplicates, and MS/MSD/spike duplicate samples as well as for investigative samples. This is most easily accomplished by specifying that samples are collected in specific sizes and types of containers which provide sufficient volume (and meet other necessary criteria) for the particular types of analyses that will be performed. Samples designated for use as the MS/MSD may require additional volume for organic analysis.

Proper sample packaging and shipping procedures to be used are presented in Chapter 5 of this QAPP.

Trip blank preparation is described in section 3.7 of this QAPP.

Field measurements will be performed in accordance with the USEPA methods listed in Table 2.

Preventive maintenance is discussed in Chapter 11 of this QAPP.

SECTION FIVE

Custody Procedures

Chain-of-custody procedures will be instituted and followed throughout the investigation. Custody is one of several factors necessary for the admissibility of environmental data as evidence in a court of law. Custody procedures help to satisfy the two major requirements for admissibility: relevance and authenticity. Sample custody is addressed in three parts: field sample collection, laboratory activities, and final evidence files. Final evidence files, including all originals of laboratory reports and purge files, are maintained under document control in a secure area. Samples are physical evidence and will be handled according to strict chain-of-custody protocols. The URS QAO must be prepared to produce documentation that traces the samples from the field to the laboratory. The USEPA has defined custody of evidence as follows:

- In actual possession
- In view after being in physical possession
- In a locked location
- In a designated, secure, restricted area.

5.1 Field Custody Procedures

The field samplers are personally responsible for the care and custody of the sample until transferred. In the field sampler's individual bound field notebook, samplers will note, with permanent ink, meteorological data, equipment employed for sample collection, calculations, information regarding collection of QA/QC samples, and any observations. All entries will be signed and dated, and any entry which is to be deleted shall use a single cross-out which is signed and dated. The following types of information will be recorded in the field notebook by the field sampling team:

- Sample number
- Project identification
- Sampling location
- Required analysis
- Date and time of sample collection
- Type and matrix of sample

SECTION FIVE

Custody Procedures

- Sampling technique
- Preservation used if applicable
- Sampling conditions
- Observations
- Initials of the sampler.

A sample label, which is shown in Figure 4, will each be attached to each investigative or QC sample and the sample placed in a shipping container. Two sample custody seals (shown in Figures 5 for Savannah Laboratories and in Figure 6 for Triangle) will be applied to coolers. The following will be recorded with permanent ink on sample labels and on chain-of-custody records by the field sampling team:

- Project name and number
- Sample number identification
- Initials of sampler
- Sampling location (if not already encoded in the sample number)
- Required analysis
- Date and time of sample collection
- Space for laboratory sample number (only on the sample tag)
- Preservative used, if applicable.

The sample identification system to be used in the field is described in Chapter 4 of this QAPP.

The field sampling team will send the coolers to the designated laboratory. For samples collected for dioxin and dibenzofuran analysis, samples will be sent to Triangle Labs. Samples will not be sent to another laboratory without the permission of USEPA Region V.

The laboratory will assign a number for each sample upon receipt.

A sample chain-of-custody form will be completed for each shipment to the analytical laboratory. The chain-of-custody will include the following information:

SECTION FIVE

Custody Procedures

- Project identification and number
- Sample description/location
- Required analysis
- Date and time of sample collection
- Type and matrix of sample
- Number of sample containers
- Analysis requested/comments
- Sampler signature/date/time
- Air bill number.

A chain-of-custody document providing all information, signatures, dates, and other information, as required on the example chain-of-custody form in Figure 2, will be completed by the field sampler and provided for each sample cooler. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the chain-of-custody. The field sampler will sign the chain-of-custody record when relinquishing custody, and include the original form in an air-tight plastic bag in the sample cooler with the associated samples. Sampling containers will be packed to help prevent breakage and cross-contamination. Samples will be shipped in coolers, each containing a chain-of-custody and ice and ice packs to maintain inside temperature at approximately 4°C. Sample coolers will then be sealed between the lid and sides of the cooler with two custody seals prior to shipment. The custody seals will consist of adhesive-backed tape that easily rips if it is disturbed. Samples will be shipped to the laboratory by common overnight carrier or will delivered by URS. Samples will be packed following applicable DOT requirements.

Samples will remain in the custody of the sampler until transfer of custody is completed. Transfer consists of:

- Delivery of samples to the laboratory sample custodian
- Signature of the laboratory sample custodian on the chain-of-custody document as receiving the samples and signature of sampler as relinquishing the samples.

If a carrier is used to take samples between the sampler and the laboratory, a copy of the air bill

SECTION FIVE

Custody Procedures

must be attached to the chain-of-custody to maintain proof of custody, and the air bill number must be written on the chain-of-custody.

5.2 LABORATORY CUSTODY PROCEDURES

Laboratory custody procedures begin when the laboratory receives the samples. When the samples arrive at the laboratory, either the mail room custodian or the sample custodian (identified in Chapter 2) will sign the vendor's air bill or bill of lading (unless hand-delivered) and the chain-of-custody. The sample custodian's duties and responsibilities upon sample receipt will be to:

- Document receipt of samples
- Inspect sample shipping containers for the presence or absence of custody seals (only if shipped via overnight courier) and for container integrity
- Check the cooler temperature and record on the chain-of-custody. If the cooler temperature is greater than 10°C, the URS QAO will be contacted
- Sign and date the appropriate forms or documents, verify and record the agreement or disagreement of information on sample documents, and, if there are discrepancies, record the problem and notify the Laboratory QAO
- Log sample information into the laboratory sample tracking system, including:
 - date and time of sample receipt
 - project number
 - field sample number
 - laboratory sample number (assigned during log-in procedure)
 - sample matrix
 - sample parameters
 - storage location
 - log-in person's initials
- Label sample with a unique, sequential laboratory sample number
- Place samples in the walk-in cooler, or sample storage area which is a secure, limited-

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Custody Procedures

access storage. The samples collected for volatile analysis will be stored in a separate refrigerator.

At the laboratory, the analysts will be required to log samples and extracts in and out of storage as the analysis proceeds. An example of the laboratory internal chain-of-custody form is provided as Figure 3. Samples and extracts will be returned to secure storage at the close of business. Written records will be kept of each time the sample or extract changes hands. Care must be exercised to properly complete, date, and sign items needed to generate data.

The laboratory must follow the following procedures:

- Samples will be handled by the minimum number of people possible.
- The laboratory will set aside a secured sample storage area consisting of a clean, dry, refrigerated, isolated room, which is capable of being locked.
- A specific person will be designated sample custodian. Incoming samples must be received by the custodian who will indicate receipt by signing the chain-of-custody form.
- The custodian will ensure that samples which are heat-sensitive, light-sensitive, radioactive, or which require special handling in other ways, are properly stored and maintained prior to analysis.
- The analytical area will be restricted to authorized personnel only.
- After sample analyses are complete, the laboratory may discard sample one month after the date on the final report. Analytical data is to be kept secured and released to authorized personnel only.

5.3 FINAL EVIDENCE FILE CHAIN-OF-CUSTODY PROCEDURES

The final evidence file will be the central repository for documents which constitute evidence relevant to sampling and analysis activities as described in this QAPP. URS is the custodian of the evidence file and maintains the contents of evidence files for the site, including relevant records, logs, field notebooks, pictures, subcontractor reports, and data reviews.

Copies of the following will be stored by the laboratory for incorporation into the sample file, if requested; the Laboratory OM will be responsible for final evidence documentation assembly:

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Custody Procedures

- Documentation of the preparation and analysis of samples, including copies of the analysts' notebooks
- Bench sheets, graphs, computer printouts, chromatograms, and mass spectra, as applicable
- Copies of QA/QC data
- Instrument logs showing the date, time, and identity of the analyst
- Analytical tracking forms that record the date, time, and identity of the analyst for each step of the sample preparation, extraction, and analysis.

Upon completion of the analyses, the URS QAO will begin assimilating the field and laboratory notes. In this way, the file for the samples will be generated. The final file for the sample will consist of the following:

- Laboratory data packages, including summary and raw data from the analysis of environmental and QC samples, chromatograms, mass spectra, calibration data, work sheets, and sample preparation logs
- Chain-of-custody records
- Data validation reports.

The following documentation will supplement the chain-of-custody records:

- Field notebooks and data
- Field collection report
- Pictures and drawings
- Progress and QA reports
- Contractor and subcontractor reports
- Correspondence.

The evidence file must be maintained in a secured, limited access area until submittals for the project have been reviewed and approved, and for a minimum of six years past the submittal date of the final report.

SECTION SIX

Calibration Procedures and Frequency

Calibration is a reproducible reference point in which all sample measurements can be correlated. A sound calibration program shall include provisions for documentation of frequency, conditions, standards, and records reflecting the calibration history of a measurement system. The accuracy of the calibration standard is important because all data will be in reference to the standards used.

Proper calibration of laboratory analytical instrumentation and field instrumentation is essential for the generation of reliable data which meets the project's DQOs. Analytical instrument calibration is monitored through the use of control limits which are established for individual analytical methods. Calibration procedures to be followed are specified, in detail. These procedures specify the type of calibration, calibration materials to be used, range of calibration, and frequency of calibration. For field analyses, calibrations must be performed and documented on the instrumentation used.

6.1 FIELD EQUIPMENT CALIBRATION

Field equipment that will be used to collect data on conductivity, pH, turbidity, temperature, organic vapors, soil gas, XRF metals, organics in soils, on-site dust concentrations, explosive atmospheres, and magnetic anomalies will be calibrated in such a manner that accuracy and reproducibility of results are consistent with the manufacturer's specifications.

Field instruments to be used that require calibration include, but are not limited to, the following:

- Hydac® pH, temperature, turbidity meter, and conductivity meter (or equivalent)
- HNu® PL-101, DL-101 PID, or Photovac MicroTIP® detector (or equivalent)
- Neotronics Mini Gas 4® Portable 4-in-1 Multi-Gas Monitor (explosimeter) (or equivalent)
- Dusttrak® Model 8520 RAM or equal (or equivalent)
- Geometrics 858 Cesium or 856AX TOTAL Field Magnetometer (or equivalent).

Equipment to be used for the field sampling will be examined to confirm that it is in good operating condition. This includes checking the manufacturer's operating manual and the instructions for each instrument to confirm that the maintenance requirements are being observed. Field notes from previous sampling trips will be reviewed so that the notations on any

SECTION SIX

Calibration Procedures and Frequency

prior equipment problems are not overlooked, and all necessary repairs to equipment have been carried out. Spare parts, including a spare pH meter electrode and a second thermometer, will be maintained at the field office.

In general, instruments will be calibrated prior to each day's use, in the middle of the day (approximately every four hours), and will be recalibrated as required. Where applicable, the linearity of the instrument will be checked by using a two-point calibration with reference standards bracketing the expected measurement. Instrument-specific operation manuals will be consulted if further detail is required. All calibration procedures performed will be documented in the field logbook.

A listing of the manuals for typical instruments is contained in Appendix A.

6.2 LABORATORY EQUIPMENT CALIBRATION

The laboratory will be responsible for proper calibration and maintenance of laboratory analytical equipment. Calibration procedures are presented in the analytical methods and the laboratory SOPs. Tables 7A through 7I present the specific calibration criteria and the conditions that will require recalibration for each method. Calibration procedures for a specific laboratory instrument will consist of initial calibration, initial calibration verification, and continuing calibration verification. The SOP for each analysis listed in Tables 4A and 4B, describes the calibration procedures, their frequency, acceptance criteria, and the conditions that will require recalibration. In all cases, the initial calibration will be verified using an independently prepared calibration verification solution. The laboratory maintains a sample logbook for each instrument which will contain the following information: instrument identification, date of calibration, analyst, calibration solutions, and the samples associated with the calibrations.

The USEPA calibration procedures and frequencies are specified in the USEPA organic and inorganic methods listed in Table 2.

6.3 STANDARDS AND SOLUTIONS

The use of standard materials of a known purity and quality is necessary for the generation of reproducible data. The laboratory will monitor the use of laboratory materials including

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Calibration Procedures and Frequency

solutions, standards, and reagents. Standards and standard solutions are obtained from the USEPA or commercial vendors. Certificates of analysis are included with each standard by the vendor.

Standards and standard solutions are verified prior to use. This verification may be in the form of a certification from the supplier. Standards may also be verified by comparison to a standard curve or another standard from a separate source. Standards are routinely checked for signs of deterioration, including unusual volume changes, discoloration, formation of precipitates, or changes in analyte response.

Solvent materials are also verified prior to use. Each new lot of solvent is analyzed to verify the absence of interfering constituents. Reagent and method blanks are routinely analyzed to evaluate possible laboratory-based contamination of samples.

6.4 RECORDS

A records book will be kept for standards and will include the following information:

- Material name
- Control or lot number
- Purity and/or concentration
- Supplier/manufacturer
- Receipt/preparation date
- Recipient's/preparer's name
- Expiration date.

These records will be checked periodically as part of the laboratory internal laboratory controls review.

6.5 CALIBRATION RECORDS

A bound notebook will be kept with each instrument that requires calibration. The notebook will contain a record of activities associated with QA monitoring and instrument repairs. These records will be checked during periodic equipment review and internal and external QA/QC audits.

SECTION SEVEN

Analytical Procedures

Wastes, soil, groundwater, and air samples collected for this project will be analyzed by Savannah Labs and/or Lancaster Labs. Samples collected for dioxin and dibenzofuran analysis will be analyzed by Triangle Labs. The specific methods listed in Table 3 and SOPs that will be utilized by the laboratory for sample analysis are presented in Tables 4A and 4B. The individual analytes for each method are presented in Tables 5A through 5P. Table 3 presents the specific QC samples to be taken for each analysis on a matrix specific basis.

7.1 FIELD ANALYTICAL PROCEDURES

The standardization and QA information for field measurements of pH, turbidity, conductivity, temperature, organic vapors, soil gas, XRF metals, organics in soils, on-site dust concentrations, potentially explosive atmospheres, and magnetic anomalies are described in Chapter 6 of this QAPP. A copy of the Health and Safety Plan and FSP have been submitted with the QAPP to expedite review and approval of these methods. Where appropriate, the methods to be used for these measurements are listed in Table 2.

7.2 LABORATORY ANALYTICAL PROCEDURES

For this QAPP, Savannah Labs, Lancaster Labs, and Triangle Labs will follow USEPA Methods listed in Table 2 and the laboratory SOPs listed in Tables 4A and 4B.

The accuracy and precision of the analytical data generated by the laboratory will be determined through the analysis of duplicate samples, spiked samples, reference standard samples, laboratory control samples, and field and laboratory blank samples analyzed along with each set of environmental samples, where applicable.

Interferences will be identified and documented. When matrix interferences are noted during sample analysis, actions will be taken by the laboratory to achieve the specified detection limits. Samples may be diluted only if target or nontarget analytes generate responses in excess of the linear range of the instrument. The Laboratory QAO will document in the case narrative that the laboratory demonstrates good analytical practices in order to achieve the specified detection limits.

Standards and reference materials will be analyzed to determine analyte concentrations for comparison with expected concentrations to provide a measure of accuracy of the methods. For organic analyses, the accuracy of the method will be determined by spiking the sample matrix

SECTION SEVEN

Analytical Procedures

with analytes and surrogates. Percent recoveries of the spikes will be calculated and compared with control limits. A measure of precision will be obtained through the RPD between matrix spikes and matrix spike duplicates. Sampling precision will be evaluated based on the RPD of duplicate field samples. RPDs will be compared to established control limits.

The generated data will be input into the laboratory's database management system. Complete descriptions of analytical procedures to be used in the laboratory are described in the SOPs and in the laboratory's Quality Assurance Manual (QAM) as listed in Tables 4A and 4B.

7.2.1 List of Project Target Compounds and Laboratory Detection Limits

Tables 5A through 5P list the project target compounds, laboratory PQLs, and MDLs for samples to be used as reference during this investigation. Actual reporting limits may be higher in some samples, for example due to dilutions caused by matrix interference or high concentrations of target analytes.

7.2.2 List of Associated QC Samples

Section 3.7 of this QAPP and Table 3 contain a listing of the associated QC samples for analytes and matrices.

SECTION EIGHT

Internal Quality Control Checks

The overall effectiveness of a quality control program depends upon operating in the field and laboratory according to a program that systematically ensures the precision and accuracy of analyses by detecting errors and preventing their recurrence or measuring the degree of error inherent in the methods applied. This section describes specific quality control checks to be addressed for both field and laboratory analyses in order to comply with the requirements of the SSP.

8.1 FIELD QUALITY CONTROL CHECKS

QC procedures for pH, turbidity, conductivity, temperature, organic vapors, soil gas, XRF metals, organics in soils, on-site dust concentrations, potentially explosive atmosphere, and magnetic anomaly measurements will include calibrating the instruments as described in Chapter 6 of this QAPP, measuring duplicate samples, and checking the reproducibility of the measurements by taking multiple readings on a single sample or reference standard. The QC information for field equipment is stated in Chapter 6 of this QAPP. Section 3.7 of this QAPP discusses the QC samples (including trip blank, equipment blank, MS/MSD, spike duplicate, and field duplicate) that will be collected during the field investigation. Table 3 lists the environmental and corresponding QC samples to be collected by analyses and matrix type.

Field sampling crews will be under direct supervision of the field sampling leader. Bound notebooks and appropriate data sheets will be used to document the collection of samples and data so that an individual sample or data set can be traced back to its point of origin, sampler, and type of sampling equipment. Sampling will be performed according to the methods provided in the FSP and this QAPP.

Assessment of field sampling precision and bias will be made by collecting field duplicates and field blanks for laboratory analysis.

8.2 LABORATORY QUALITY CONTROL CHECKS

Tables 7A through 7I summarize the laboratory QC requirements, frequency, control limits, and laboratory corrective actions for each analytical method. In addition, the specific SOPs, as listed in Tables 4A and 4B, provide a description of the specific QC requirements.

All data obtained will be properly recorded. The data package will include a full deliverable package capable of allowing the recipient to reconstruct QC information and compare it to QC

SECTION EIGHT

Internal Quality Control Checks

criteria, and perform data validation. Samples analyzed in nonconformance with the QC criteria will be reanalyzed by the laboratory.

A brief description of laboratory QA/QC analyses for organics and inorganics is contained in the following subsections.

8.2.1 Calibration

Compliance requirements for satisfactory instrument calibration are established to verify that the instrument is capable of producing acceptable quantitative data. Initial calibration demonstrates that the instrument is capable of acceptable performance at the beginning of analysis, and calibration verification and performance checks document satisfactory maintenance and adjustment of the instrument on a day-to-day basis.

8.2.2 Blanks

Several types of blanks will be analyzed by the laboratory. Corrective action procedures will be implemented and documented for blank analyses if target compounds are detected at concentrations greater than the acceptable criteria. The criteria for evaluation of blanks apply to any blank associated with a group of samples. If problems with a blank exist, data associated with the project must be carefully evaluated to establish whether or not there is an inherent variability in the data for the project, or if the problem is an isolated occurrence not affecting other data.

A reagent blank consists of organic-free distilled water and any reagents added to a sample during analysis only, or straight solvent. This type of sample is analyzed to evaluate whether contamination is occurring during the analysis of the sample. A reagent blank is usually analyzed following highly contaminated samples to assess the potential for cross-contamination during analysis.

A method blank is organic-free water which undergoes the preparation procedures applied to a sample. These samples are analyzed to examine whether sample preparation and analysis techniques result in sample contamination. The laboratory will prepare and analyze a method blank with each group of twenty samples of similar matrix that are analyzed at the same time or one method blank per each 12-hour analytical sequence for GC/MS analysis.

Field and trip blanks will also be collected and submitted for laboratory analysis, where

SECTION EIGHT

Internal Quality Control Checks

appropriate. Field and trip blanks will be handled in the same manner as environmental samples. Field and trip blanks are analyzed to assess contamination introduced during field sampling procedures and sample shipment, respectively.

8.2.3 Internal Standards Performance

Internal standards, which are compounds not found in environmental samples, will be spiked into blanks, samples, MS/MSDs, and LCSs at the time of sample preparation. Internal standards for polychlorinated dibenzodioxin (PCDD) and polychlorinated dibenzofuran (PCDF) analyses are used to quantitate target compounds and to correct for variability of sample preparation, cleanup, and analysis with respect to individual sample matrices. Internal standards must meet retention time and performance criteria specified in the analytical method or the sample will be reanalyzed.

8.2.4 Recovery Standard

Recovery standards consist of two labeled PCDDs and PCDFs which are spiked into environmental samples, blanks, and QC samples prior to sample injection for PCDF and PCDD analyses. Recovery standards are used to monitor instrument performance by evaluating retention time shifts and are used to quantitate results of internal standards.

8.2.5 Surrogate Recovery

Accuracy and matrix biases for individual samples are monitored for organic analyses using surrogate additions. Surrogates are compounds similar in nature to the target analytes which are spiked into environmental samples, blanks, and quality control samples prior to sample preparation for organic analyses. The evaluation of the results of these surrogate spikes is not necessarily straightforward. The sample itself may produce effects due to such factors as interferences and high concentrations of analytes. Since the effects of the sample matrix are frequently outside the control of the laboratory and may present relatively unique problems, the review and validation of data based on specific sample results is frequently subjective.

SECTION EIGHT

Internal Quality Control Checks

8.2.6 Laboratory Control Sample Analyses

LCSs are standard solutions that consist of known concentrations of the target analytes spiked into laboratory organic-free distilled water or clean sand. They are prepared or purchased from a certified manufacturer from a source independent from the calibration standards to provide an independent verification of the calibration procedure. They are spiked with all target analytes. These QC samples are then prepared and analyzed following the same procedures employed for environmental sample analysis to assess method accuracy independently of sample matrix effects. The laboratory will prepare and analyze an LCS with each group of twenty samples of similar matrix that are analyzed at the same time or each 12-hour analytical sequence period for GC/MS analysis. Percent-recoveries will be compared to laboratory control limits to assess the efficiency of preparation and analysis method independent of environmental sample matrix effects.

8.2.7 MS/MSD/Spike Duplicate Samples

MS/MSD and spike duplicate analyses will be performed on environmental samples at a frequency of one per sample matrix and every twenty samples of similar matrix. Whenever possible, MS/MSD and spike duplicate samples will be prepared and analyzed within the same batch as the environmental samples. MS/MSD and spike duplicate samples will be spiked at the laboratory with all target analytes. MS/MSD and spike duplicate data are generated to determine long-term precision and accuracy of the analytical method with respect to sample matrices.

8.2.8 Laboratory Duplicate or Matrix Spike Duplicate Samples

Laboratory duplicate or MSD analyses will be performed on environmental samples at a frequency of one per sample matrix and every twenty samples of similar matrix for inorganic analyses. Whenever possible, laboratory duplicate or MSD samples will be prepared and analyzed within the same batch as the environmental samples. Laboratory duplicate or MSD data are generated to determine long-term precision of the analytical method with respect to sample matrices.

8.2.9 Compound Identification and Quantitation

The objective of the qualitative criteria is to minimize the number of erroneous identifications of compounds. An erroneous identification can either be a false positive (reporting a compound present when it is not) or a false negative (not reporting a compound that is present). The

SECTION EIGHT

Internal Quality Control Checks

identification criteria can be applied much more easily in detecting false positives than false negatives. Negatives, or non-detected compounds, on the other hand represent an absence of data and are, therefore, much more difficult to assess. The objective for quantitative requirements is to maximize the accuracy of data and sensitivity of the instrument. Samples will be analyzed undiluted when technically feasible (due to carryover or instrument contamination) to maximize sensitivity and to meet QAPP guidance criteria. Samples must be reanalyzed at the appropriate dilution when concentrations exceed the linear calibration range to maximize accuracy.

8.2.10 Control Limits

Laboratory control limits are established separately for each matrix type for each type of analysis. Laboratory control limits can be considered action limits. These limits are defined as \pm three standard deviations of the mean and correspond to 99.7% confidence limits of a normal distribution curve. The laboratory will establish control limits for each analyte of concern using a minimum of twenty data points. Laboratory control limits may change since limits are minimally updated on a yearly basis with the addition of new data points.

The laboratory control limits used to assess data for this program will be summarized by the laboratory in the analytical report.

Data Reduction, Validation,

SECTION NINE

Reporting, and Data Management

For data to be scientifically valid, legally defensible, and comparable, valid procedures must be used to prepare these data. The following describes the data reduction, validation, and reporting procedures to be used for the Laboratory data.

Data reduction is the process of converting raw analytical data to final results in proper reporting units. Data reporting is the detailed description of the data deliverables used to completely document the analysis, calibration, quality control measures, and calculations. Data validation is the process of qualifying analytical/measurement data on the performance of the field and laboratory quality control measures incorporated into the sampling and analysis procedures.

Specific laboratory procedures and instrumentation can be found in the QAM and/or SOPs listed in Tables 4A and 4B. The data production and reporting procedures described below will be employed at the laboratory.

All data generated through field activities and analyzed by the laboratory shall be reduced by the laboratory, reported to URS, data validated, then reported to USEPA Region V.

9.1 DATA REDUCTION

9.1.1 Field Data Reduction Procedures

Field data reduction procedures will be minimal in scope compared to those implemented in the laboratory. Only direct reading instrumentation will be employed in the field. The use of pH, conductivity, and turbidity meters, thermometers, PIDs, field gas chromatograph and mass spectrometer, XRF meters, RAMs, explosimeters, and magnetometers will generate some measurements directly read from the meters following calibration by the respective manufacturer's recommendations. Such data will be written into field notebooks immediately after measurements are taken. If errors are made, results will be legibly crossed out, initialed, and dated by the field member, and corrected in a space adjacent to the original entry. Later, when the results forms are filled out, the URS Field Leader will proof the forms to assess whether transcription errors have been made.

9.1.2 Laboratory Data Reduction Procedures

Data reduction consists of manual and computer data reduction procedures and calculations. Computer data reduction procedures and calculations will be checked manually by the laboratory to verify that compound identification and quantitation adhere to method requirements. The

SECTION NINE

laboratory will be responsible for maintaining a listing of computer-based data reduction programs which it uses for data reduction. Sample preparation or extraction logs will be used to document sample preparation information (for example, preparation weights, volumes, and reagents). Instrument injection logs or bench sheets will also be maintained for each instrument. The equations that will be used in reducing data are those listed in the USEPA methods. Analytical results for soil samples shall be calculated and reported on a dry weight basis.

QC data will be compared to the method acceptance criteria. Data considered to be acceptable will be entered into the laboratory computer system. Data summaries will be sent to the Laboratory QAO for review. Unacceptable data shall be appropriately qualified in the project report. Case narratives will be prepared which will include information concerning data that fell outside acceptance limits, and any other anomalous conditions encountered during sample analysis. After the Laboratory QAO or Laboratory PM approves these data, they are considered ready for data validation.

Qualitative identification and quantitation of organic analytes will be performed by experienced analysts in accordance with analytical method requirements.

Analytical results are generally entered into the laboratory computer system by the analyst, independently reviewed by another analyst or supervisor experienced in the method, and approved by the Laboratory QAO or Laboratory PM. The following are requirements that are generally examined as part of this review:

- Initial calibration criteria were met. Standards in the calibration curve covered the expected concentration ranges of the samples.
- Initial and continuing calibrations met the acceptance criteria defined in the method standard procedure
- Sample results fell within the range of the standard curve
- For GC/MS methods requiring internal standards, retention times and area responses were evaluated against limits established by the daily calibration
- Method blanks were processed with each analytical batch and no detectable levels of contamination were identified (with the possible exception of common laboratory contaminants)

Data Reduction, Validation,

SECTION NINE

Reporting, and Data Management

- MS/MSDs were performed at the required frequency and recoveries were within acceptable control limits
- Duplicate analyses were performed at the required frequency and results were within the advisory control limits
- LCS analyses were performed with each analytical batch and the results obtained were within control limits
- For organic compound analyses, surrogate spike recoveries were within control limits
- Compounds identified by GC/MS have been manually rechecked by comparison with the data system library for both target compounds and tentatively identified compounds. Retention times and ratios of fragmentation were verified.
- Calculations have been accurately performed
- Reporting units are correct
- Data for the analysis provide a complete audit trail
- Reported detection limits comply with data quality indicator requirements.

The analyst's supervisor will check a minimum of 10% of the data back to raw data in the secondary review, (or as outlined in the laboratory QAPP). When required analyses on the samples in a project are complete, entered, and reviewed, a report will be generated.

The report will be forwarded to the Laboratory QAO for review. The report will then be reviewed for the following items (at a minimum):

- QC data will be reviewed to identify whether or not internal specification and contract requirements have been met
- Non-conformance reports, if any, will be reviewed for completion of corrective actions and their impact of results. Non-compliance and corrective action procedures will be documented in the case narrative in the final report.

The report requires the signature of the Laboratory QAO or Laboratory PM. Electronic data are copied onto computer tape, inventoried, and stored off-site in a secure facility, or within locked cabinets on-site. This data archive system is maintained minimally for ten years.

SECTION NINE

9.2 DATA VALIDATION

Data validation procedures shall be performed for both field and laboratory operations.

9.2.1 Procedures Used to Evaluate Field Data

Procedures to evaluate field data for this project primarily include checking for transcription errors on the part of field crew members and review of field notebooks. This task will be the responsibility of the URS Field Leader, who will otherwise not participate in making any of the field measurements or in adding notes, data, or other information to the notebook.

9.2.2 Procedures to Validate Laboratory Data

Data validation will be performed by the URS QA Manager in accordance with QA/QC criteria established in this QAPP, as listed in Tables 7A through 7I, and the analytical methods for 100% of the analytical data. Excursions from QA/QC criteria will be qualified based on guidance provided in the following documents or the most recent USEPA data validation guidelines:

- *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review*. USEPA 540/R-94/012 (USEPA, October 1999)
- *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*. USEPA 540/R-94/013 (USEPA, 1994d)
- *USEPA Region II Data Validation SOP For SW-846 Method 8290 Polychlorinated Dibenzodioxins (PCDDs) and Polychlorinated Dibenzofurans (PCDFs) By High-Resolution Gas Chromatography High-Resolution Mass Spectrometry (HRGC/HRMS)* (USEPA, 1994e).

The analytical data from each method and matrix will be reviewed for the QC parameters as presented in the following section. Data validators will recalculate 10% of the laboratory sample calculations using raw data when verifying sample results. In addition, data validators will review 10% of the raw data to verify that compound identification was performed correctly and transcription errors are not present.

Data quality will be evaluated using method or laboratory control limits. Any control limits outside of the acceptable range shall be identified and reported. Sample data will be qualified based on excursions from method or laboratory control limits. Data not within control limits require corrective action by the laboratory. Data validators will check corrective actions and

Data Reduction, Validation,

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Reporting, and Data Management

results of reanalysis and document these events in the validation report.

Minor deficiencies in the data generation process noted in the data validation will result in approximation of sample data. Approximation of a data point indicates uncertainty in the reported concentration of the chemical but not its assigned identity. Major deficiencies noted in the data, validation will result in the rejection of sample results. Rejected data would be considered unusable for quantitative or qualitative purposes. Data qualifiers may include the following:

- U Indicates that the compound was analyzed for, but was not detected. The sample quantitation limit is presented and adjusted for dilution and percent moisture. This qualifier is also used to signify that the detection limit of an analyte was raised as a result of analytes detected in laboratory and/or field blank samples.
- J Indicates that the detected sample result should be considered approximate based on excursions from QA/QC criteria.
- UJ Indicates that the detection limit for the analyte in this sample should be considered approximate based on excursions from QA/QC criteria.
- R Indicates that the previously reported detection limit or sample result has been rejected due to a major excursion from QA/QC criteria, for example percent recoveries of less than ten percent. The data should not be used for qualitative or quantitative purposes.

The following method specific QA/QC parameters will be evaluated (at a minimum) during the data validation, where applicable.

Analyses for VOCs and SVOCs (where applicable)

- Holding times, sample preservation, and percent solids
- Dilutions
- GC/MS tuning criteria
- Initial and continuing calibration
- Blank analysis
- Surrogate recovery
- MS/MSD analysis

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- Field duplicate analysis
- Laboratory Control Sample (LCS) analysis
- Internal standards performance
- Compound identification and quantitation
- Reported detection limits
- System performance
- Documentation completeness
- Overall assessment.

Analyses for pesticides, PCBs, and herbicides (where applicable):

- Holding times, sample preservation, and percent solids
- Dilutions
- GC performance
- Analytical sequence
- Initial and continuing calibration
- Blank analysis
- Surrogate recovery
- MS/MSD analysis
- Field duplicate analysis
- LCS and MS blank analysis
- Retention time windows
- Analyte identification, quantitation, and reported detection limits
- Cleanup efficiency verification
- Confirmation analysis
- System performance

SECTION NINE

- Documentation completeness
- Overall assessment.

Analysis for metal, mercury, cyanide, total organic carbon (TOC), fluoride, total phosphorus, and orthophosphate analyses (where applicable):

- Holding times, sample preservation, and percent solids
- Contract required detection limit (CRDL) standard analysis criteria
- Initial and continuing calibration
- Blank analysis
- ICP interference check sample analysis
- Spike duplicate analysis
- Field duplicate analysis LCS analysis
- Laboratory duplicate analysis
- ICP serial dilution analysis
- Furnace atomic absorption analysis
- Verification of instrument parameters
- Instrument detection limits
- Linear ranges
- Analyte quantitation, and reported detection limits
- Documentation completeness
- Overall assessment.

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Analysis for PCDDs and PCDFs analyses (where applicable):

- Holding times, sample preservation, and percent solids
- GC/MS tuning criteria
- Column performance check standard analysis
- Initial and continuing calibration
- Blank analysis
- Internal standard criteria
- Recovery standard criteria
- MS/MSD analysis
- Field duplicate analysis
- Compound identification and quantitation
- Confirmation analysis
- System performance
- Documentation completeness
- Overall assessment.

The laboratory will be conducting analyses on samples in accordance with methods listed in Table 3 and the laboratory's SOPs. Data generated by this SSP will be computerized in a format organized to facilitate data review and evaluation. The computerized data set will include the data flags provided by Savannah Labs and Triangle Labs as well as the data validation results.

9.3 DATA REPORTING

Data reporting procedures shall be carried out for field and laboratory operations as indicated below:

SECTION NINE

9.3.1 Field Data Reporting

Field data reporting shall be conducted principally through the transmission of field logs containing tabulated results of all measurements made in the field, and documentation of all field calibration activities.

9.3.2 Laboratory Data Reporting

Data generated through field activities and analyzed by the laboratory shall be reduced by the laboratory, reported to URS, data validated, then reported to USEPA Region V.

The Laboratory QAO, Laboratory OM, and Laboratory PM must perform a final review of the report summaries and case narratives to determine whether the report meets project requirements. The data packages provided by the laboratory will provide information so that a complete data validation can be performed on the data generated for this project.

The data report forms will be securely bound and pages will be sequentially numbered. The laboratory will provide data reports that will include the following information (at a minimum):

- Case narrative report containing a summary of the samples collected, problems with sample receipt, methods employed, QA/QC excursions, and corrective action procedures
- Cross-reference table of sample identifications, laboratory sample identifications, sample matrix, analysis required and performed, date of sample collection, and date of sample receipt
- Case file containing documentation of cooler temperature and preservation checks performed
- Copies of completed chain-of-custody records
- Internal laboratory chain-of-custody records
- Analytical results of environmental samples, field duplicates, equipment blanks, and trip blanks with appropriate reporting limits
- Surrogate recovery results with appropriate laboratory control limits
- Batch-specific QA/QC results for laboratory method blanks, MS/MSDs, and LCSs with appropriate laboratory control limits

SECTION NINE

Data Reduction, Validation, Reporting, and Data Management

- GC/MS tuning data
- Initial and continuing calibration data summarized
- GC/MS internal standard summary forms
- Metals ICP quality control data summarized
- Summary table of MDLs and laboratory reporting limits
- Sample preparation bench sheets, digestion logs, and injection logs
- Appropriate raw instrument outputs for samples, blanks, QA/QC samples, and calibration standards
- Sample data
- Extraction log information
- Corrective action logs.

Tentatively identified compounds will not be reported for this project.

Standard preparation logs, use logs, and MDL studies will be made available by the laboratory upon request.

Review and cross-checking procedures will be as described in the laboratory SOPs and will ensure that the raw data and calculation results are properly, completely, and accurately transferred to the laboratory reporting format. In addition to the hardcopy version of the analytical data packages, the laboratory will provide electronic deliverables.

9.4 DATA MANAGEMENT

Data will be managed in a relational database management system (DBMS). Laboratory analytical data will be provided in electronic disk deliverable (EDD) format for direct upload into the DBMS. Associated field data will be entered into the DBMS by hand.

The DBMS will then be used to provide custom queries and reports to support data validation, data analysis, and report preparation.

SECTION TEN

Performance and Systems Audits

The performance audit is an independent check to evaluate the quality of data being generated. The system audit is an on-site review and evaluation of the laboratories, instrumentation, quality control practices, data validation, and documentation procedures.

At the discretion of the URS PM, performance and system audits of both field and laboratory activities will be conducted to verify that sampling and analyses are performed in accordance with the procedures established in the FSP and this QAPP. The audits of field and laboratory activities include two independent parts: internal and external audits.

If requested, the internal audits will be performed by the URS QAO. The external audits will be performed by USEPA Region V.

10.1 FIELD PERFORMANCE AND SYSTEM AUDITS

10.1.1 Internal Field Audits

Internal field audit responsibilities. Internal audits of field activities including sampling and field measurements will be conducted by the URS QAO or his designee.

Internal field audit frequency. These audits will verify that established procedures are being followed. Internal field audits will be conducted at least once at the beginning of the site sample collection activities and annually thereafter.

Internal field audit procedures. The audits will include examination of field sampling records, field instrumentation operating records, sample collection, handling and packaging in compliance with the established procedures, maintenance of QA procedures, chain-of-custody, and other elements of the field program. Follow-up audits will be conducted to correct deficiencies and to verify that QA procedures are maintained throughout the SSP. The audits will involve review of field measurement records, instrumentation calibration records, and sample documentation. The areas of concern in a field audit include:

- Sampling procedures
- Decontamination of sampling equipment, if applicable
- Chain-of-custody procedures

SECTION TEN

Performance and Systems Audits

- SOPs
- Proper documentation in field notebooks.

10.1.2 External Field Audits

External field audit responsibilities. External field audits may be conducted by USEPA Region V.

External field audit frequency. External field audits may be conducted at any time during the field operations. These audits may or may not be announced and are at the discretion of USEPA Region V.

Overview of the external field audit process. External field audits will be conducted according to the field activity information presented in this QAPP.

10.2 LABORATORY PERFORMANCE AND SYSTEM AUDITS

10.2.1 Internal Laboratory Audits

Internal laboratory audit responsibilities. The internal laboratory audit will be conducted by the URS QAO or designee.

Internal laboratory audit frequency. The internal laboratory system audits will be conducted on an annual basis while the internal laboratory performance audits will be conducted on a quarterly basis.

Internal laboratory audit procedures. The internal laboratory system audits will include an examination of laboratory documentation on sample receiving, sample log-in, sample storage, chain-of-custody procedures, sample preparation, and analysis, instrumentation operating records, etc. The performance audits will involve reviewing the results for performance evaluation samples sent to the laboratory by regulating agencies. The URS QAO or designee will evaluate the analytical results to ensure the laboratory maintains acceptable QC performance.

10.2.2 External Laboratory Audits

External laboratory audit responsibilities. An external audit may be conducted by USEPA Region V.

SECTION TEN

Performance and Systems Audits

External laboratory audit frequency. An external laboratory audit may be conducted at least once prior to the initiation of the sampling and analysis activities. These audits may or may not be announced and are at the discretion of US EPA Region V.

Overview of the external laboratory audit process. External laboratory audits will include review of laboratory analytical procedures, laboratory on-site audits, and/or submission of performance evaluation samples to the laboratory for analysis.

The specific parameters to be evaluated (at a minimum) will include:

- Data comparability
- Calibration and quantitation
- QC execution
- Out-of-control events
- SOPs
- Sample management
- Record keeping
- Instrument calibration records
- Other analytical records
- QC records
- Corrective action reports
- Maintenance logs
- Data review
- Limits of detection
- QC limits
- Analytical methods.

SECTION ELEVEN

Preventive Maintenance

11.1 FIELD INSTRUMENT PREVENTIVE MAINTENANCE

The field equipment for this project includes a pH meter, a conductivity meter, a turbidity meter, thermometers, a PID, a field gas chromatograph and mass spectrometer, XRF meter, a RAM, an explosimeter, and a magnetometer. Specific preventive maintenance procedures to be followed for field equipment are those recommended by the manufacturer. Field instruments will be checked and calibrated daily before use. Calibration checks will be documented in the field notebooks. Critical spare parts such as tape and batteries will be kept on-site to reduce downtime.

11.2 LABORATORY INSTRUMENT PREVENTIVE MAINTENANCE

As part of their QA/QC programs, routine preventive maintenance programs are conducted by Savannah Labs and/or Lancaster Labs and by Triangle Labs to minimize the occurrence of instrument failure and other system malfunctions. Savannah Labs and/or Lancaster Labs and Triangle Labs perform routine scheduled maintenance and coordinate with the vendor for the repair of all instruments. Laboratory instruments are maintained in accordance with manufacturer's specifications and the requirements of the specific method employed. This maintenance is carried out on a regular, scheduled basis, and is documented in the laboratory instrument maintenance logbook for each instrument. Emergency repair or scheduled manufacturer's maintenance is provided under a repair and maintenance contract with factory representatives.

Table 8 and Table 9 provide examples of preventive maintenance for field laboratory equipment.

SECTION TWELVE

Specific Routine Procedures Used to Assess Data Precision, Accuracy, and Completeness

The procedures to assess the quality of data generated in the laboratory may include, but not be limited to, the following:

- Determination of analytical precision per method
- Determination of analytical accuracy per method
- Determination of analytical completeness.

The quality of data will be determined through evaluation of the appropriate QC measurements according to the specific analytical method used.

Precision and accuracy will be assessed utilizing method limits or control charts, where applicable. Control charts will consist of line graphs which provide a continuous graphic representation of the state of each analytical procedure. The standard deviation of the mean of the QC measurement is calculated, and the upper and lower warning limits are set at plus or minus two standard deviation units. The upper and lower control limits are set at plus or minus three standard deviation units. Acceptable data are realized when results fall between the lower and upper warning limits. If the QC value falls between the control limit and the warning limit, the analysis should be scrutinized as possibly out-of-control.

In general, the accuracy of the methods will be determined by spiking the sample matrix with the analyte and by analyzing reference materials with known concentrations, where applicable. The spiking levels will be selected to reflect the concentration range of interest. Percent recoveries of the spikes and reference materials will be calculated and compared to the established limits. The precision of the methods will be determined by the analysis of MS and laboratory and field duplicate samples. The precision will be evaluated by calculating the RPD between the duplicates. RPD calculations will be compared to the established limits.

The definitions and equations used for the assessment of data quality are discussed below.

12.1 ACCURACY ASSESSMENT

Accuracy is a measure of the nearness of an analytical result, or a set of results, to the true value. It is usually expressed in terms of error, bias, or percent recovery (%R).

Normally, the term accuracy is used synonymously with percent recovery. It describes either the

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Specific Routine Procedures Used to Assess Data Precision, Accuracy, and Completeness

recovery of a synthetic standard of known value, or the recovery of known amount of analyte (spike) added to a sample of known value. The %R or accuracy can be calculated by using:

standards: $\%R = (\text{observed value} / \text{true value}) \times 100$

spikes: $\%R = (\text{conc. spike} + \text{sample conc.}) - (\text{sample conc.} \times 100) / \text{conc. spike}$

12.2 PRECISION ASSESSMENT

Precision refers to the agreement or reproducibility of a set of replicate results among themselves without assumption of any prior information as to the true result. It is usually expressed in terms of the percent difference (%D) or RPD. The %D is calculated by using:

$\%D = (\text{larger SR} - \text{smaller SR} \times 100) / \text{smaller SR}$

where SR is the sample result. The RPD is calculated by using:

$RPD = (|OSR - DSR| \times 100) / ((OSR + DSR) / 2)$

where OSR is the original sample result and DSR is the duplicate sample result.

12.3 COMPLETENESS ASSESSMENT

The completeness is the ratio of the number of valid sample results to the total number of samples analyzed for a specific matrix and/or analysis. It is calculated by using the following equation:

$\text{Completeness} = \text{number of valid measurements} / \text{number of measurements planned} \times 100.$

SECTION THIRTEEN

Corrective Action

Corrective action is the process of identifying, recommending, approving and implementing measures to counter unacceptable procedures or out-of-control performance which can affect data quality. Corrective action can occur during field activities, laboratory analyses, data validation, and data assessment. Corrective actions proposed and implemented will be documented in the regular quality assurance reports to management. Corrective action should only be implemented after approval by the URS PM, or the URS Field Leader. If immediate corrective action is required, approvals secured by telephone from the URS PM should be documented in an additional memorandum.

For noncompliance problems, a formal corrective action program will be developed and implemented at the time the problem is identified. The person who identifies the problem will be responsible for notifying the URS PM, who in turn will notify the URS PO. Implementation of a corrective action will be confirmed in writing through the same channels. Nonconformance with the established quality control procedures in this QAPP, SSP or FSP will be identified and corrected in accordance with this QAPP.

13.1 FIELD CORRECTIVE ACTION

Corrective action in the field can be needed when the sample network is changed (i.e., more or less samples, sampling location changes, and related modifications) or sampling procedures and/or field analytical procedures require modification due to unexpected conditions. Technical staff and project personnel will be responsible for reporting suspected technical or QA nonconformities or suspected deficiencies of any activity or issued document by reporting the situation to the URS Field Leader. The URS Field Leader will be responsible for assessing the suspected problems in consultation with the URS PM and assessing the potential for the situation to impact the quality of the data. If the situation warrants a reportable nonconformance requiring corrective action, then a nonconformance report will be initiated by the URS PM.

The URS PM will be responsible for seeing that corrective action for nonconformance are initiated by:

- Evaluating reported nonconformities
- Controlling additional work on nonconforming items
- Establishing disposition or action to be taken

SECTION THIRTEEN

Corrective Action

- Maintaining a log of nonconformities
- Verifying nonconformance reports and corrective actions taken
- Verifying nonconformance reports are included in the final site documentation in project files.

If appropriate, the URS Field Leader will verify that no additional work that is dependent on the nonconforming activity is performed until the corrective actions are completed. Corrective action for field measurements may include:

- Repeat the measurement to check the error
- Check for all proper adjustments for ambient conditions such as temperature
- Check the batteries
- Re-calibration
- Check the calibration
- Replace the instrument or measurement devices.
- Stop work (if necessary).

The URS Field Leader is responsible for site activities. In this role, the URS Field Leader at times is required to adjust the site programs to accommodate site-specific needs. When it becomes necessary to modify a program, the responsible person notifies the URS Field Leader of the anticipated change and implements the necessary changes after obtaining the approval of the URS Field Leader. The change in the program will be documented on the field change request (FCR) that will be signed by the initiators and the URS Field Leader. The FCR for each document will be numbered serially as required. The FCR shall be attached to the file copy of the affected document. The URS Field Leader must approve the change in writing or verbally prior to field implementation, if feasible. If unacceptable, the action taken during the period of deviation will be evaluated in order to ascertain the significance of any departure from program practices and action taken.

The URS Field Leader is responsible for the controlling, tracking, and implementing the identified changes. Reports on changes will be distributed to all affected parties, including USEPA Region V.

SECTION THIRTEEN

Corrective Action

Corrective action resulting from internal field audits will be implemented immediately if data may be adversely affected due to unapproved or improper use of approved methods. The URS QAO will identify deficiencies and recommend corrective action to the URS PM. Implementation of corrective actions will be performed by the URS Field Leader and the field team. Corrective action will be documented in the quality assurance report to the project management.

Corrective actions will be implemented and documented in the field notebook. No staff member will initiate corrective action without prior communication of findings through the proper channels. If corrective actions are insufficient, work may be stopped by USEPA Region V.

13.2 LABORATORY CORRECTIVE ACTION

Corrective action in the laboratory may occur prior to, during, and after initial analysis. A number of conditions, such as broken sample containers, multiple phases, low or high pH readings, or potentially high concentration samples may be identified during sample log-in or just prior to analysis. Following consultation with laboratory analysts and section leaders, it may be necessary for the Laboratory QAO to approve the implementation of corrective action. Tables 7A through 7I specify conditions during or after analysis that may automatically trigger corrective action or optional procedures. These conditions may include dilution of samples or automatic reinjection or reanalysis of samples.

Corrective actions are required whenever an out-of-control event or potential out-of-control event is noted. The investigative action taken is somewhat dependent on the analysis and the event.

Laboratory personnel are alerted that corrective actions may be necessary if:

- QC data are outside the acceptable windows for precision and accuracy
- Blanks contain target analytes above acceptable levels
- Undesirable trends are detected in spike recoveries or RPD between duplicates
- There are unusual changes in the detection limits

SECTION THIRTEEN

Corrective Action

- Deficiencies are detected by the QA Department during internal or external audits or from the results of performance evaluation samples
- Inquiries concerning data quality are received.

Corrective action procedures are often handled at the bench level by the analyst, who reviews the preparation or extraction procedure for possible errors, checks the instrument calibration, spike and calibration mixes, instrument sensitivity, etc. If the problem persists or cannot be identified, the matter is referred to the Laboratory OM, Laboratory PM, and Laboratory QAO for further investigation. Once resolved, full documentation of the corrective action procedure is filed with the QA department.

Tables 7A through 7I describe the quality control requirements and the corrective actions associated with those requirements for each type of analysis required for this SSP.

These corrective actions are performed prior to release of the data from the laboratory. The corrective actions will be documented in both the laboratory corrective action log and the case narrative. If corrective action does not rectify the situation, the laboratory will contact the URS QAO.

13.3 CORRECTIVE ACTION DURING DATA VALIDATION AND DATA ASSESSMENT

The URS QAO and Laboratory QAO may identify the need for corrective action during either the data validation or data assessment. Potential types of corrective action may include resampling by the field team or reinjection or reanalysis of samples by the laboratory.

These actions are dependent upon the ability to mobilize the field team or whether the data to be collected are necessary to meet the required quality assurance objectives. When the URS QAO or Laboratory QAO identifies a corrective action situation, it is the URS PM who will be responsible for approving the implementation of corrective action, including resampling, during data assessment. Corrective actions of this type will be documented by the URS QAO and the Laboratory QAO.

SECTIONFOURTEEN

Quality Assurance Reports to Management

The deliverables associated with the tasks identified in the SSP and monthly progress reports will contain a separate QA section in which data quality information collected during the task is summarized. Those reports will be the responsibility of the URS PM and will include the URS QAO and Laboratory QAO report on the accuracy, precision, and completeness of the data as well as the results of the performance and system audits, and any corrective action needed or taken during the project.

14.1 CONTENTS OF PROJECT QA REPORTS

The QA reports will contain on a routine basis results of field and laboratory audits, information generated during the past month reflecting the achievement of specific data quality objectives, and a summary of corrective action that was implemented and its immediate results on the project. The status of the project with respect to the project schedule will be established. Whenever necessary, changes in key personnel and anticipated problems in the field or the laboratory for the coming month that could bear on data quality, along with proposed solutions, will be reported. Detailed references to QAPP modifications will also be highlighted. QA reports will be prepared in written format by the URS PM. In the event of an emergency, or in case it is essential to implement corrective action immediately, QA reports can be made by telephone to the appropriate individuals, as identified in the project organization section of this QAPP. However, these events and their resolution will be addressed thoroughly in the next issue of the monthly QA report.

14.2 FREQUENCY OF QA REPORTS

The QA reports will be prepared on a monthly basis. The reports will continue without interruption until the project has been completed.

14.3 INDIVIDUALS RECEIVING/REVIEWING QA REPORTS

Individuals identified in Chapter 2 of this QAPP will receive copies of the monthly QA reports.

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References

- U.S. Environmental Protection Agency (USEPA). 1980. *Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans*, QAMS-005/80.
- U.S. Environmental Protection Agency (USEPA). 1983; *Methods for Chemical Analysis of Water and Wastes*, Cincinnati, Ohio.
- U.S. Environmental Protection Agency (USEPA). 1988. *Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air*, EPA/600/4-89/017, June 1988, Research Triangle Park, NC.
- U.S. Environmental Protection Agency (USEPA). 1993. *Method for the Determination of Inorganic Substances in Environmental Chemical Analysis for Water and Wastes*, EPA-600/4-79-020, Cincinnati, Ohio.
- U.S. Environmental Protection Agency (USEPA). 1993b. *Region V Standard Operating Procedure For Validation of CLP Inorganic Data*.
- U.S. Environmental Protection Agency (USEPA). 1993c. *Data Quality Objectives Process For Superfund, Interim Final Guidance*.
- U.S. Environmental Protection Agency (USEPA). 1994a. *Guidance for the Data Quality Objectives Process* USEPA QA/G-4.
- U.S. Environmental Protection Agency (USEPA). 1994b. *Requirements for Quality Assurance Project Plans for Environmental Data Operation* USEPA QA/R-5.
- U.S. Environmental Protection Agency (USEPA). 1994c. *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review*, USEPA 540/R-94/012, Washington, D.C.
- U.S. Environmental Protection Agency (USEPA). 1994d. *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*, USEPA 540/R-94/013, Washington, D.C.
- U.S. Environmental Protection Agency (USEPA). 1994e. *Region II Data Validation SOP For SW-846 Method 8290 Polychlorinated Dibenzodioxins (PCDDs) and Polychlorinated Dibenzofurans (PCDFs) By High-Resolution Gas Chromatography/High-Resolution Mass Spectrometry (HRGC/HRMS)*.
- U.S. Environmental Protection Agency (USEPA). 1996. *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, SW-846, 3rd Edition*. Washington D.C.
- U.S. Environmental Protection Agency (USEPA). 1996. *Region V Superfund Model Quality Assurance Project Plan*, Revision 1.
- U.S. Environmental Protection Agency (USEPA). 1997. *Region V Standard Operating Procedure For Validation of CLP Organic Data*.

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References

Ecology and Environment, Inc. 1998. *Sauget Area 2 Data Tables/Maps*.

U.S. Environmental Protection Agency (USEPA). 2000. *Final Administrative Order by Consent, Sauget Area 2 Site, Sauget and Cahokia, Illinois*.

URS Corporation. 2001. *Field Sampling Plan, Sauget Area 2 Support Sampling Project, Sauget and Cahokia, Illinois Volume 2*.

URS Corporation. 2001. *Health and Safety Plan, Sauget Area 2 Support Sampling Project, Sauget and Cahokia, Illinois, Volume 2*.

Solutia Inc. 2001. *Sauget Area 2, Sauget and Cahokia, Illinois, Support Sampling Plan*.

Tables

TABLE 1
Sampling Efforts, Objectives, Analyses, Data Uses , and Analytical Level

Sampling Effort	Objective	Types of Analysis	Data Uses	Analytical Level
Soil Gas Survey	Quantify total VOCs at sites O, P, Q, R, and S	Total VOCs	Identify extent of total VOC containing soils in the fill area	Screening data
GC/MS Sampling	Quantify VOCs and SVOCs at site Q	VOCs, SVOCs	Determine concentrations of VOCs and SVOCs	Screening data
XRF Sampling	Quantify metals at site Q	Metals	Determine concentrations of certain metals	Screening data
Waste Sampling	Quantify VOCs, SVOCs, pesticides, PCBs, herbicides, and metals at sites O, P, Q, R, and S	TCLP-VOCs, TCLP-SVOCs, TCLP-pesticides, TCLP-PCBs, TCLP-herbicides, TCLP-metals, TCLP-dioxin	Identify nature of waste materials	Definitive data
Groundwater Sampling	Quantify constituents at sites O, P, Q, R, and S	VOCs, SVOCs, pesticides, PCBs, herbicides, metals, dioxin, ORP, DO, ferrous iron, nitrate, manganese, sulfate, alkalinity, methane, carbon dioxide	Identify and quantify constituents in monitoring wells, alluvial aquifer, and bedrock aquifer	Definitive data
Groundwater Sampling	Quantify parameters in wells and aquifers	Grain size, particle size distribution, porosity, bulk density, specific gravity, moisture content, pH, total organic carbon	Identify groundwater flow direction, aquifer properties	Definitive data
Soil Sampling	Quantify VOCs, SVOCs, pesticides, PCBs, herbicides, metals, and dioxin at sites O, P, Q, R, and S	VOCs, SVOCs, pesticides, PCBs, herbicides, metals, dioxin	Identify and quantify constituents in soil	Definitive data

TABLE 1
Sampling Efforts, Objectives, Analyses, Data Uses , and Analytical Level

Sampling Effort	Objective	Types of Analysis	Data Uses	Analytical Level
Air Sampling	Quantify VOCs, SVOCs, pesticides, PCBs, herbicides, metals, and dioxin in ambient air	VOCs, SVOCs, pesticides, PCBs, herbicides, metals, dioxin	Identify and quantify constituents in air upwind and downwind of sites O, P, Q, R, and S	Definitive data
Pilot Test Sampling	Collect leachate and groundwater samples for treatability study	By technology contractors	Treatability studies, technology evaluations	Screening data
Stormwater Sampling	Quantify VOCs, SVOCs, pesticides, PCBs, herbicides, and metals at sites Q and R	VOCs, SVOCs, pesticides, PCBs, herbicides, metals, dioxin	Identify and quantify constituents entering and exiting the sites through storm water runoff	Definitive data

Notes:

GC/MS indicates gas chromatography coupled with mass spectrometry

XRF indicates x-ray fluorescence spectroscopy

VOCs indicate volatile organic compounds.

SVOCs indicate semivolatile organic compounds.

PCBs indicate polychlorinated biphenyls.

ORP indicates oxygen reduction potential.

DO indicates dissolved oxygen.

TCLP indicates toxicity characteristic leaching procedure, which is performed to prepare a leachate, which is analyzed for VOCs, SVOCs, pesticides, PCBs, herbicides, metals, and dioxins.

VOCs in
AIR
SOP protocols =
Myanmar
Custodian
STL

TABLE 2
Analytical Methods for Parameters

Parameter	Sample Media	Analytical Method	References
Total VOCs	Soil gas	EPA Method 3810 Modified	1
TCLP Extraction/VOCs	Waste	EPA Method 1311/8260B	1
VOCs	Leachate, soil, groundwater, seeps, stormwater runoff	EPA Method 8260B	1
Field Screening VOCs	Soil	EPA Method 8260B	7
VOCs	Air	EPA Method TO1/8260B	2
TCLP Extraction/SVOCs	Waste	EPA Method 1311/8270C	1
SVOCs	Leachate, soil, groundwater, seeps, stormwater runoff	EPA Method 8270C	1
Field Screening SVOCs	Soil	EPA Method 8270C	7
SVOCs	Air	EPA Method TO13/8270C	2
TCLP Extraction/Pesticides	Waste	EPA Method 1311/8081A	1
Pesticides	Leachate, soil, groundwater, seeps, stormwater runoff	EPA Method 8081A	1
Pesticides	Air	EPA Method TO13/8081A	2
TCLP Extraction/Herbicides	Waste	EPA Method 1311/8151A	1
Herbicides	Leachate, soil, groundwater, seeps, stormwater runoff	EPA Method 8151A	1
Herbicides	Air	EPA Method TO13/8151A	2
TCLP Extraction/PCBs	Waste	EPA Method 1311/680	1, 4
PCBs	Leachate, soil, groundwater, seeps, stormwater runoff	EPA Method 680	4
PCBs	Air	EPA Method TO13/680	2
TCLP Extraction/Metals	Waste	EPA Method 1311/6010B	1

TABLE 2
Analytical Methods for Parameters

Parameter	Sample Media	Analytical Method	References
Metals	Leachate, soil, groundwater, seeps, stormwater runoff	EPA Method 6010B	1
Field Screening Metals	Soil	EPA Method 6200	7
Metals	Air	EPA Method 6010B	1
TCLP Extraction/Dioxin	Waste	EPA Method 1311/8280	1
Dioxin	Leachate, soil	EPA Method 8280	1
Dioxin	Groundwater, seeps, stormwater runoff	EPA Method 8290	1
Dioxin	Air	EPA Method TO9/8290	2
ORP	Groundwater	ASTM D-1498	5
DO	Groundwater	EPA Method 360.1/360.2 or Field Measurement	5
Ferrous Iron	Groundwater	EPA Method 3500-Se-D or Field Measurement	5
Manganese	Groundwater	EPA Method 6010B	5
Nitrate	Groundwater	EPA Method 353.2	5
Sulfate	Groundwater	EPA Method 375.4	5
Alkalinity	Groundwater	EPA Method 310.1	5
Methane	Groundwater	EPA Method RSK 175	5
Carbon Dioxide	Groundwater	EPA Method 310.1	5
Grain Size	Soil	ASTM D-422	6
Particle Size Distribution	Soil	ASTM D-422	6
Porosity	Soil	Calculation	6
Bulk Density	Soil	ASTM D-2937	6
Specific Gravity	Soil	ASTM D-854	6
Moisture Content	Soil	ASTM D-2216	6
pH	Soil	EPA Method 9040/9045	3
TOC	Soil	EPA Method 9060	1

680
my
Triangle
PCBs

Notes:

VOCs indicate volatile organic compounds.

SVOCs indicate semivolatile organic compounds.

PCBs indicate polychlorinated biphenyls.

TOC indicates total organic carbon.

TCLP indicates toxicity characteristic leaching procedure, which is performed to prepare a leachate, which is analyzed for VOCs, SVOCs, pesticides, PCBs, herbicides, metals, and dioxins.

- 1 USEPA. 1996a. *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, SW-846*, 3rd Edition. Washington D.C.
- 2 USEPA. 1998. *Compendium of Methods for the Determination of Toxic Compounds in Ambient Air*, Research Triangle Park, NC.
- 3 USEPA. 1983. *Methods for Chemical Analysis of Water and Wastes*, Cincinnati, Ohio.
- 4 USEPA. 1985. *Determination of Pesticides and PCBs in Water and Soil/Sediment by Gas Chromatography/Gas Spectrometry, Physical and Chemical Methods Branch*, Environmental Monitoring and Support Laboratory, Office of Research and Development, Cincinnati, Ohio.
- 5 Phone conversation with Angie Weimerskirk from Savannah Laboratory on February 2, 2001.
- 6 ASTM. 1998. *Annual Book of ASTM Standards, Construction, Volume 04.08*, Easton, MD.
- 7 URS Corporation. 2001. *RI/FS Support Sampling Plan Vol. 2A Appendix A*, Maryland Heights, MO.

TABLE 3
Field Sampling Summary for Chemical/Geochemical Analyses

Parameter (Critical Method)	Matrix	Sample Containers And Volumes	Preservation	Holding Times	Number Of Samples (FD-MS/MSD)	QC sample frequency			
						Field Duplicate	Trip Blank	MS/MSD /Spike Duplicate*	Equip. Blank**
VOCs (EPA Method 8260B) ¹	Groundwater/ Storm Water Runoff	3-40 milliliter glass vials with Teflon® lined septum caps	4°C HCl to pH<2 FC	14 days from collection	279/9 (28-14)/(1-1)	One per 10 samples or one per matrix (for less than 10 samples)	1 ea. per cooler with VOC samples	One per 20 samples or one per matrix (for less than 20 samples)	One per 10 samples as required
VOCs (EPA Method 8260B) ¹	Waste/ soil/ leachate	3- Encore sampler™ (or in accordance with USEPA Method 5035)	4°C	Transferred to soil container or analyzed 48 hours from collection For TCLP-VOCs, 14 days from collection to TCLP extract generation, 14 days from TCLP extraction to analysis	48/60/6 (5-3)/(6-3)/(1-1)	One per 10 samples or one per matrix (for less than 10 samples)	1 ea. per cooler with VOC samples	One per 20 samples or one per matrix (for less than 20 samples)	One per 10 samples as required
VOCs (EPA Method TO1) ²	Air	Sample cartridge/ filter as described in Method TO1	4°C	7 days from collection or analysis	16 (2-1)	One per 10 samples or one per matrix (for less than 10 samples)	NA	One per 20 samples or one per matrix (for less than 20 samples)	One per 10 samples as required
SVOCs (EPA Method 8270C) ¹	Groundwater/ Storm Water Runoff	2-one liter amber glass container with Teflon® lined screw caps	4°C FC	7 days from collection to extraction; 40 days from extraction to analysis	279/9 (28-14)/(1-1)	One per 10 samples or one per matrix (for less than 10 samples)	NA	One per 20 samples or one per matrix (for less than 20 samples)	One per 10 samples as required

TABLE 3
Field Sampling Summary for Chemical/Geochemical Analyses

Parameter (Critical Method)	Matrix	Sample Containers And Volumes	Preservation	Holding Times	Number Of Samples (FD-MS/MSD)	Field Duplicate	QC sample frequency		
							Trip Blank	MS/MSD /Spike Duplicate*	Equip. Blank**
SVOCs (EPA Method 8270C) ¹	Waste/ soil/ leachate	250 milliliter wide mouth glass container with Teflon® lined lid	4°C	14 days from collection to extraction; 40 days from extraction to analysis For TCLP-SVOCs, 14 days from collection to TCLP extract generation, 7 days form TCLP extract generation to extraction, 40 days from extraction to analysis	48/60/6 (5-3)/(6-3)/(1-1)	One per 10 samples or one per matrix (for less than 10 samples)	NA	One per 20 samples or one per matrix (for less than 20 samples)	One per 10 samples as required
SVOCs (EPA Method TO13) ²	Air	Sample cartridge/ filter as described in Method TO13	4°C	7 days from collection or analysis	16 (2-1)	One per 10 samples or one per matrix (for less than 10 samples)	NA	One per 20 samples or one per matrix (for less than 20 samples)	One per 10 samples as required
Pesticides, Herbicides (EPA Methods 8081A, 8151) ¹	Groundwater/ Storm Water Runoff	4-one liter amber glass container with Teflon® lined screw caps	4°C	7 days from collection to extraction; 40 days from extraction to analysis	90/9 (9-5)/(1-1)	One per 10 samples or one per matrix (for less than 10 samples)	NA	One per 20 samples or one per matrix (for less than 20 samples)	One per 10 samples as required

TABLE 3
Field Sampling Summary for Chemical/Geochemical Analyses

Parameter (Critical Method)	Matrix	Sample Containers And Volumes	Preservation	Holding Times	Number Of Samples (FD-MS/MSD)	Field Duplicate	<u>QC sample frequency</u>		
							Trip Blank	MS/MSD /Spike Duplicate*	Equip. Blank**
Pesticides, Herbicides (EPA Methods 8081A, 8151) ¹	Waste/ soil/ leachate	250 milliliter wide mouth glass container with Teflon® lined lid	4°C	14 days from collection to extraction; 40 days from extraction to analysis For TCLP, 14 days from collection to TCLP extract generation, 14 days form TCLP extract generation to extraction, 40 days from extraction to analysis	48/60/6 (5-3)/(6-3)/(1-1)	One per 10 samples or one per matrix (for less than 10 samples)	NA	One per 20 samples or one per matrix (for less than 20 samples)	One per 10 samples as required
Pesticides, Herbicides (EPA Methods TO13) ²	Air	Sample cartridge/ filter as described in Method TO13	4°C	7 days from collection or analysis	16 (2-1)	One per 10 samples or one per matrix (for less than 10 samples)	NA	One per 20 samples or one per matrix (for less than 20 samples)	One per 10 samples as required
PCBs (EPA Method 680) ⁴	Groundwater/ Storm Water Runoff	2-one liter amber glass container with Teflon® lined screw caps	4°C	7 days from collection to extraction; 40 days from extraction to analysis	90/9 (9-5)/(1-1)	One per 10 samples or one per matrix (for less than 10 samples)	NA	One per 20 samples or one per matrix (for less than 20 samples)	One per 10 samples as required

TABLE 3
Field Sampling Summary for Chemical/Geochemical Analyses

Parameter (Critical Method)	Matrix	Sample Containers And Volumes	Preservation	Holding Times	Number Of Samples (FD-MS/MSD)	Field Duplicate	QC sample frequency		
							Trip Blank	MS/MSD /Spike Duplicate*	Equip. Blank**
PCBs (EPA Method 680) ⁴	Waste/ soil/ leachate	500 milliliter wide mouth glass container with Teflon® lined lid	4°C	14 days from collection to extraction; 40 days from extraction to analysis	48/60/6 (5-3)/(6-3)/(1-1)	One per 10 samples or one per matrix (for less than 10 samples)	NA	One per 20 samples or one per matrix (for less than 20 samples)	One per 10 samples as required
PCBs (EPA Method TO13) ²	Air	Sample cartridge/ filter as described in Method TO13	4°C	7 days from collection to analysis	16 (2-1)	One per 10 samples or one per matrix (for less than 10 samples)	NA	One per 20 samples or one per matrix (for less than 20 samples)	One per 10 samples as required
***Dioxin, Dibenzofuran (EPA Method 8290) ¹	Groundwater/ Storm Water Runoff	2-one liter amber glass container with Teflon® lined screw caps	4°C FC	30 days from collection to extraction; 45 days from extraction to analysis	27/9 (3-2)/(1-1)	One per 10 samples or one per matrix (for less than 10 samples)	NA	One per 20 samples or one per matrix (for less than 20 samples)	One per 10 samples as required
***Dioxin, Dibenzofuran (EPA Method 8280A) ¹	Waste/ soil/ leachate	100 grams in 4 oz. amber glass jar with Teflon® lined lid	4°C	30 days from collection to extraction; 45 days from extraction to analysis	48/60/6 (5-3)/(6-3)/(1-1)	One per 10 samples or one per matrix (for less than 10 samples)	NA	One per 20 samples or one per matrix (for less than 20 samples)	One per 10 samples as required

TABLE 3
Field Sampling Summary for Chemical/Geochemical Analyses

Parameter (Critical Method)	Matrix	Sample Containers And Volumes	Preservation	Holding Times	Number Of Samples (FD-MS/MSD)	Field Duplicate	QC sample frequency		
							Trip Blank	MS/MSD /Spike Duplicate*	Equip. Blank**
Dioxin, Dibenzofuran (EPA Method TO9) ²	Air	Sample cartridge/ filter as described in Method TO9	4°C	7 days from collection to analysis	16 (2-1)	One per 10 samples or one per matrix (for less than 10 samples)	NA	One per 20 samples or one per matrix (for less than 20 samples)	One per 10 samples as required
Metals (EPA Method 6010B) ¹	Groundwater/ Storm Water Runoff	1-250 or 500 milliliter polyethylene or fluorocarbon (TFE or PFA) container	4°C HNO ₃ to pH<2	180 days from collection	90/9 (9-5)/(1-1)	One per 10 samples or one per matrix (for less than 10 samples)	NA	One per 20 samples or one per matrix (for less than 20 samples)	One per 10 samples as required
Metals (EPA Method 6010B) ¹	Waste/ soil/ leachate	4 ounce wide mouth polyethylene or fluorocarbon (TFE or PFA) container	4°C	180 days from collection For TCLP, 180 days from collection to TCLP extract generation, 180 days from extraction to analysis	48/60/6 (5-3)/(6-3)/(1-1)	One per 10 samples or one per matrix (for less than 10 samples)	NA	One per 20 samples or one per matrix (for less than 20 samples)	One per 10 samples as required
Metals (EPA Method 6010B) ¹	Air	Sample cartridge/ filter as described in Method 6010B	4°C	7 days from collection or analysis	16 (2-1)	One per 10 samples or one per matrix (for less than 10 samples)	NA	One per 20 samples or one per matrix (for less than 20 samples)	One per 10 samples as required

TABLE 3
Field Sampling Summary for Chemical/Geochemical Analyses

Parameter (Critical Method)	Matrix	Sample Containers And Volumes	Preservation	Holding Times	Number Of Samples (FD-MS/MSD)	Field Duplicate	QC sample frequency		
							Trip Blank	MS/MSD /Spike Duplicate*	Equip. Blank**
ORP (ASTM D-1498) ⁵	Groundwater	250 milliliter plastic container	4°C	As soon as possible	90 (9-5)	One per 10 samples or one per matrix (for less than 10 samples)	NA	One per 20 samples or one per matrix (for less than 20 samples)	One per 10 samples as required
DO (EPA Method 360.1/360.2) ⁵ or Field Measurement	Groundwater	100 milliliter plastic container	4°C	As soon as possible	90 (9-5)	One per 10 samples or one per matrix (for less than 10 samples)	NA	One per 20 samples or one per matrix (for less than 20 samples)	One per 10 samples as required
Ferrous Iron (EPA Method 3500-Fe-D) ⁵ or Field Measurement	Groundwater	250 milliliter plastic container	4°C HCl to pH<2	As soon as possible	90 (9-5)	One per 10 samples or one per matrix (for less than 10 samples)	NA	One per 20 samples or one per matrix (for less than 20 samples)	One per 10 samples as required
Manganese (EPA Method 6010B) ¹	Groundwater	1-250 or 500 milliliter polyethylene or fluorocarbon (TFE or PFA) container	4°C HNO ₃ to pH<2	180 days from collection	90 (9-5)	One per 10 samples or one per matrix (for less than 10 samples)	NA	One per 20 samples or one per matrix (for less than 20 samples)	One per 10 samples as required
Nitrate (EPA Method 353.2) ⁵	Groundwater	250 milliliter plastic container	4°C	48 hours	90 (9-5)	One per 10 samples or one per matrix (for less than 10 samples)	NA	One per 20 samples or one per matrix (for less than 20 samples)	One per 10 samples as required

TABLE 3
Field Sampling Summary for Chemical/Geochemical Analyses

Parameter (Critical Method)	Matrix	Sample Containers And Volumes	Preservation	Holding Times	Number Of Samples (FD-MS/MSD)	QC sample frequency			
						Field Duplicate	Trip Blank	MS/MSD /Spike Duplicate*	Equip. Blank**
Sulfate (EPA Method 375.4) ⁵	Groundwater	250 milliliter plastic container	4°C	28 days	90 (9-5)	One per 10 samples or one per matrix (for less than 10 samples)	NA	One per 20 samples or one per matrix (for less than 20 samples)	One per 10 samples as required
Alkalinity (EPA Method 310.1) ⁵	Groundwater	250 milliliter plastic container	4°C	14 days	90 (9-5)	One per 10 samples or one per matrix (for less than 10 samples)	NA	One per 20 samples or one per matrix (for less than 20 samples)	One per 10 samples as required
Methane (EPA Method RSK 175) ⁵	Groundwater	40 milliliter VOA vial	4°C	14 days	90 (9-5)	One per 10 samples or one per matrix (for less than 10 samples)	NA	One per 20 samples or one per matrix (for less than 20 samples)	One per 10 samples as required
Carbon Dioxide (EPA Method 310.1) ⁵	Groundwater	40 milliliter VOA vial	4°C	14 days	90 (9-5)	One per 10 samples or one per matrix (for less than 10 samples)	NA	One per 20 samples or one per matrix (for less than 20 samples)	One per 10 samples as required
Grain Size (ASTM D-422) ⁶	Soil	4 ounce wide mouth glass container with Teflon® lined lid	4°C	As soon as possible	27 (3-2)	NA	NA	NA	NA

TABLE 3
Field Sampling Summary for Chemical/Geochemical Analyses

Parameter (Critical Method)	Matrix	Sample Containers And Volumes	Preservation	Holding Times	Number Of Samples (FD-MS/MSD)	Field Duplicate	QC sample frequency		
							Trip Blank	MS/MSD /Spike Duplicate*	Equip. Blank**
Particle Size Distribution (ASTM D-422) ⁶	Soil	4 ounce wide mouth glass container with Teflon® lined lid	4°C	As soon as possible	27 (3-2)	NA	NA	NA	NA
Bulk Density (ASTM D- 2937) ⁶	Soil	4 ounce wide mouth glass container with Teflon® lined lid	4°C	As soon as possible	27 (3-2)	NA	NA	NA	NA
Specific Gravity (ASTM D-854) ⁶	Soil	4 ounce wide mouth glass container with Teflon® lined lid	4°C	As soon as possible	27 (3-2)	NA	NA	NA	NA
Moisture Content (ASTM D-2216) ⁶	Soil	4 ounce wide mouth glass container with Teflon® lined lid	4°C	As soon as possible	27 (3-2)	NA	NA	NA	NA

TABLE 3
Field Sampling Summary for Chemical/Geochemical Analyses

Parameter (Critical Method)	Matrix	Sample Containers And Volumes	Preservation	Holding Times	Number Of Samples (FD-MS/MSD)	QC sample frequency			
						Field Duplicate	Trip Blank	MS/MSD /Spike Duplicate*	Equip. Blank**
pH (EPA Method 9040/9045) ³	Soil	100 ml plastic container	4°C	As soon as possible	27 (3-2)	One per 10 samples or one per matrix (for less than 10 samples)	NA	NA	One per 10 samples as required
TOC (EPA Method 9060) ¹	Soil	4 ounce wide mouth glass container with Teflon® lined lid	4°C	28 days from collection	27 (3-2)	One per 10 samples or one per matrix (for less than 10 samples)	NA	One per 20 samples or one per matrix (for less than 20 samples)	One per 10 samples as required

Notes:

* MS/MSD indicates matrix spike/matrix spike duplicate sample for organic analyses. Spike duplicate is performed for inorganic analyses.

** Field/equipment blank is required at a frequency of one per 10 samples or one per matrix if less than ten samples are collected. Equipment blank is not required if disposable equipment is used.

*** For dioxin and dibenzofuran sample collection, QC samples, including MS/MSD and field duplicates must be clearly noted on the chain-of-custody.

Equip. indicates equipment.

FC indicates that if free chlorine is present in samples, it must be removed by the appropriate addition of Na₂S₂O₃.

VOCs indicate volatile organic compounds.

SVOCs indicate semivolatile organic compounds.

PCBs indicate polychlorinated biphenyls.

TOC indicates total organic carbon.

TCLP indicates toxicity characteristic leaching procedure, which is performed to prepare a leachate, which is analyzed for VOCs, SVOCs, pesticides, PCBs, herbicides, metals, and dioxins

NA indicates not applicable.

ORP indicates oxygen reduction potential.

DO indicates dissolved oxygen.

TABLE 3
Field Sampling Summary for Chemical/Geochemical Analyses

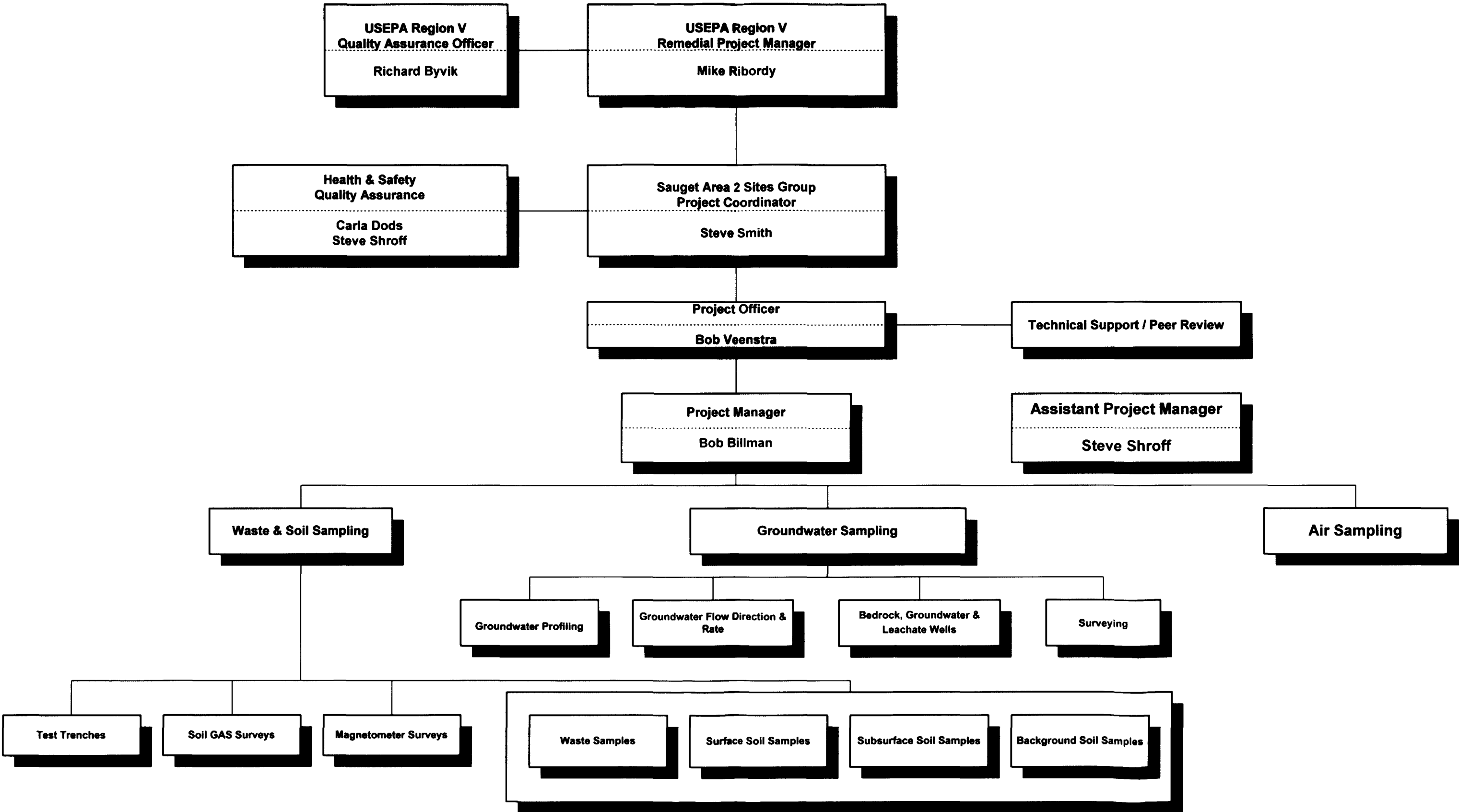
- 1 USEPA. 1996a. *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods*, SW-846, 3rd Edition. Washington D.C.
- 2 USEPA. 1988. *Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air*, EPA/600/4-89/017, Research Triangle Park, NC.
- 3 USEPA. 1983. *Methods for Chemical Analysis of Water and Wastes*, Cincinnati, Ohio.
- 4 USEPA. 1985. *Determination of Pesticides and PCBs in Water and Soil/Sediment by Gas Chromatography/Mass Spectrometry*, Physical and Chemical Branch, Environmental Monitoring and Support Laboratory, Office of Research and Development, Cincinnati, Ohio.
- 5 Phone conversation with Steve White from Savannah Laboratory on February 6, 2001.
- 6 ASTM. 1998. *Annual Book of ASTM Standards, Construction, Volume 04.08*, Easton, MD.

Tables

Tables 4 through 9 will be finalized upon selection of analytical laboratories and review of their relevant Standard Operating Procedures and Quality Assurance Manuals.

Figures

Figure 1
Sauget Area 2 RI/FS - Waste, Soil & Groundwater
Project Organization



Page ____ of ____

[illegible]

SAUGET AREA 2 RI/FS SUPPORT SAMPLING PLAN SAUGET, ILLINOIS		PROJECT NO. 2320010024.00
URS		
DRN. BY: djd 2/7/01 DSGN. BY: sjs CHKD. BY:	Example Chain-of-Custody	FIG. NO. 2

ICP METALS SAMPLE CONTROL LOG

QC Batch #:

Date Digested:

[illegible]

SAUGET AREA 2 RI/FS SUPPORT SAMPLING PLAN
SAUGET, ILLINOIS

N	PROJECT NO.
	2320010024.00

URS

DRN. BY: djd 2/7/01
DSGN. BY: sjs
CHKD. BY:

Example Laboratory Internal Chain of Custody Form

FIG. NO.	3
----------	---

Sample ID	Date
Sampled By	Time
Location	Preservation
Analysis	URS Corporation

SAUGET AREA 2 RI/FS SUPPORT SAMPLING PLAN SAUGET, ILLINOIS		PROJECT NO. 2320010024.00
URS		
ORN. BY: djd 2/7/01 DSGN. BY: sjs CHKD. BY:	Example Sample Label	FIG. NO. 4

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

OFFICIAL SAMPLE SEAL

Sample ID				SEAL NUMBER	
LOCATION					
DATE	DATE	TIME			

SAUGET AREA 2 RI/FS SUPPORT SAMPLING PLAN
SAUGET, ILLINOIS

PROJECT NO.
2320010024.00

URS

DRN. BY: djd 2/7/01
DSGN. BY: sjs
CHKD. BY:

Example Custody Seal for Savannah
Laboratories & Environmental
Services, Inc

FIG. NO.
5

TO BE PLACED ACROSS BOTTLE CAP AFTER SAMPLING

CUSTODY SEAL

SHIP TO TRIANGLE LABS

NAME: _____

SIGNATURE: _____

DATE: _____

TO BE PLACED ACROSS BOTTLE CAP AFTER SAMPLING

SAUGET AREA 2 RI/FS SUPPORT SAMPLING PLAN
SAUGET, ILLINOIS

PROJECT NO.
2320010024.00

URS

DRN. BY: djd 2/7/01
DSGN. BY: sjs
CHKD. BY:

Example Custody Seal for Triangle
Laboratories, Inc

FIG. NO.
6

APPENDIX A

Field Equipment Instruction Manuals

APPENDIX A

Field Equipment Instruction Manuals

Copies of manufacturer's operations manuals for all field instruments to be used will be kept on-site during the field efforts. These manuals will be used for all calibration and operation activities.

Instruments which would typically be used in this program include a Honba U-10 Water Quality Meter, a Passport Combustible Gas Meter, and a Photovac 2020 photoionization detection.